Getting to the Meat of It: Investigating Meat Consumption, Meat Reduction and the Potential for Pro-Environmental Behavioural Spillover

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Preface

Some of the results presented in chapter 4, specifically the findings from interviews with meat-eating participants, are also reported in the following publication:

Wolstenholme, E., Poortinga W., & Whitmarsh, L. (2019). Motives Driving Meat Consumption and Peoples' Willingness to Change. In Reese, G., Rompke A., Mues, A., & Brockmuhl K., (Eds.) *Green Ways –Perspectives of Environmental Psychology Research* (pp. 101-105).

Some of the results presented in chapters 6 and 7, specifically the survey results for red and processed meat consumption, as well as pro-environmental identity and behavioural spillover, are also reported in the following publication:

Wolstenholme, E., Poortinga, W., & Whitmarsh, L. E. (2020). Two Birds, One Stone: The Effectiveness of Health and Environmental Messages to Reduce Meat Consumption and Encourage Pro-Environmental Behavioural Spillover. *Frontiers in Psychology*, *11*, 2596. https://doi.org/10.3389/FPSYG.2020.577111

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Thesis summary

The production of livestock for meat and dairy consumption has significant negative impacts on the environment and is a major contributing factor to climate change. Moreover, red and processed meat consumption is associated with various negative health outcomes, including an increased risk of contracting various non-communicable diseases. Against this background, this thesis aimed to investigate the different factors associated with meat consumption and meat reduction, as well as people's awareness of the negative impacts of meat on the environment (chapters 4 and 5). Following from this, this thesis aimed to test the effectiveness of a randomised messaging intervention on reducing red and processed meat consumption, and to investigate what foods might be used by participants as meat replacements (chapter 6). Finally, this thesis aimed to investigate whether a reduced red and processed meat consumption might lead to a greater willingness to perform other untargeted pro-environmental behaviours, through positive behavioural spillover (chapter 7). This was achieved using a sequential qualitative-quantitative mixed-methods design, including qualitative interviews, as well as quantitative surveys and food diaries, with different participant samples.

Chapter 4 showed that habit, taste, concern for health, and social norms, played an important role in motivating meat consumption. While animal welfare was the main motive for vegetarian and vegan diets, health was the main motive for meat reduction among meat-eating participants. Awareness of the environmental impacts of meat was low among meat-eating participants and higher among vegan and vegetarian participants. Chapter 5 showed that although many participants had not previously considered reducing their red and processed meat consumption, they were not reluctant to do so. Participants' intentions and readiness to reduce their consumption was associated with positive attitudes and a strong perceived social pressure towards reducing their red and processed meat intake, as well as high self-efficacy and perceptions that a reduced meat consumption be beneficial, with few perceived barriers. Chapter 6 showed that providing information on the

environmental and health impacts of meat was effective in reducing participants' red and processed meat consumption, with some effects lasting one month later. However, the results did not shed any light on the types of foods used to replace red and processed meat. Chapter 7 did not show any conclusive evidence of positive behavioural spillover. However, there was also no evidence of negative spillover, meaning the intervention presented in chapter 6 successfully reduced participants' red and processed meat consumption without inadvertently increasing negative environmental impact, for example through moral licencing or contribution ethic effects.

Overall, this thesis contributes to a greater understanding of the motives driving meat consumption and meat reduction. In addition to contributing to the emerging literature on these topics, the findings have direct applications for the development of strategies aimed at encouraging a reduced meat consumption, to mitigate rising greenhouse gas emissions whilst also benefitting people's health.

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List of Abbreviations

GHG	Greenhouse gases
TTM	Transtheoretical model
TPB	Theory of planned behaviour

Chapter 1: Background

1.1 Introduction

The production of meat and dairy has significant negative impacts on almost all aspects of the environment, including air, land, soil, water, biodiversity, and importantly, climate change (e.g. Bailey, Froggatt, & Wellesley, 2014; Steinfeld et al., 2006). Methane, nitrous oxide and carbon dioxide are released at every stage of livestock production for meat and dairy, from the conversion of land for animal feed, through the heating and cooling of farm buildings, to the digestive processes and manure of the animals, as well as the processing and transportation of animal products to consumers (Wellesley, Happer, Froggatt & Philo, 2015). As such, the production of livestock for meat and dairy is a major driver of climate change, estimated to account for around 14.5% of global greenhouse gas emissions (Bailey et al., 2014; Gerber et al., 2013). Despite this, most people in high-income countries eat high amounts of meat that exceed nutritional needs (Sans & Combris, 2015), while meat consumption in lower income countries is also increasing (Tilman & Clark, 2014). This has led to a growing consensus that reducing excess meat consumption will be necessary to meet climate change targets, whilst also benefitting people's health (e.g. Bajželj et al., 2014; Hedenus, Wirsenius & Johansson, 2014; Ritchie, Reay & Higgins, 2018; Tilman & Clark, 2014). However, attempts to reduce meat consumption remain absent from most climate change mitigation strategies, given that such strategies have low political appeal and could be unpopular among the public (Laestadius, Neff, Barry, Frattaroli, 2014). This has led to a lack of media attention and low public awareness of the link between meat production and climate change in many countries (Wellesley et al., 2015). As a result, it is not clear whether individuals would be willing to reduce their meat consumption or how such a dietary shift could be encouraged. This thesis aims to address these issues.

This chapter provides an overview of the environmental issues associated with livestock production for meat and dairy. Section 1.2 describes the negative environmental impacts of meat and dairy production. Section 1.3 focusses on the link between meat production, greenhouse gas emissions and climate change, specifically. Section 1.4 describes the incompatibility between projected trends for meat and dairy consumption and the need to curb rising greenhouse gas emissions to meet climate change targets. Section 1.5 discusses reducing meat consumption as a climate change mitigation strategy. Section 1.6 describes the coinciding benefits associated with meat reduction. Section 1.7 describes the lack of public awareness regarding environmental issues associated with meat and public acceptability of meat reduction. The final section of this chapter, 1.8, provides an overview of the remainder of this thesis.

1.2 Environmental issues associated with meat production

The production of livestock for meat and dairy consumption has significant negative impacts on almost all aspects of the environment. The rearing of livestock requires considerable amounts of land and water, placing unsustainable pressures on natural resources (e.g. see Alexander et al., 2016; Mekonnen, & Hoekstra, 2016; Wirsenius, Azar & Berndes, 2010). For example, approximately 75% of global agricultural land and 8% of global water is used for the rearing of livestock, when land and freshwater supplies are already scare in many regions (Foley et al., 2011; Lambin & Meyfroidt, 2011; Schlink, Nguyen & Viljoen, 2010). The production of meat is also inefficient compared to the production of other foods. For example, the production of beef, pork and chicken require nine, three and four times, respectively, the amount of water used to produce cereal (Bailey et al., 2014; Mekonnen & Hoekstra, 2012). Furthermore, for the same amount of protein (50g), beef emits approximately 12 times the amount of carbon dioxide than soy (Parodi et al., 2018). Additionally, meat production contributes to issues surrounding global food security. For example, one third of global cereal crops are fed to animals when many of these crops could instead be directly fed to humans (FAO 2006 cited in Godfray et al., 2010). Indeed, it is estimated that more crops could be fed to animals than humans by the year 2050 (Pradhan, Lüdeke, Reusser, & Kropp, 2013).

Furthermore, changes in land for the rearing of livestock contribute to a range of other environmental issues. For example, improper management of livestock numbers can lead to land degradation through overcrowding and overgrazing (FAO, 2009). Meat production is also a major driver of deforestation, as forests are cleared to provide pastures and cropland for livestock (Bailey et al., 2014). Runoff of harmful substances accumulated in soil via livestock manure and fertilizer used to grow animal feed can also lead to water pollution and aquatic biodiversity loss (Tamminga, 2003). Livestock production can also result in harmful substances being released into the air, reducing air quality and contributing towards acid rain, which may damage crops, land and water sources (Steinfield et al., 2006). Importantly, the production of livestock for meat and dairy is also responsible for the release of potent greenhouse gases, contributing significantly to climate change.

1.3 Meat Production as a driver of climate change

Livestock production for meat and dairy is increasingly being recognized as a major contributing factor towards climate change (e.g. Bailey et al., 2014; Wellesley, et al., 2015). Greenhouse gases (GHGs) are released at nearly every stage of livestock production, from the production of animal feed to the transportation of finalised animal products to supermarket shelves (Bailey et al., 2014). The different sources of emissions before, during and after livestock production can be viewed in Figure 1. Nitrous oxide is released via fertilizer used for feed crops and through livestock manure; methane is released through livestock digestive processes; and carbon dioxide is released through changes in land as well as the processing and transportation of animal products (Gerber et al., 2013). For example, the expansion of cropland to provide pasture accounts for the emission of approximately 2.4 billion tonnes of carbon dioxide each year (Steinfied et al., 2006). The livestock sector is the largest global source of methane and nitrous oxide, which have global warming potentials 23 and 296 times, respectively, that of carbon dioxide (Steinfield et al., 2006). Specifically, the livestock sector is estimated to account for 9% of total anthropogenic carbon-dioxide emissions, 37% of methane emissions and 65% of nitrous oxide emissions (Steinfield et al., 2006). Overall, livestock production accounts for approximately 14.5% of global anthropogenic GHG emissions, which is more than those emitted from the transportation sector (Bailey et al., 2014). The main greenhouse gas emitted from the livestock sector is methane, accounting for approximately 44% of the sector’s emissions, followed by nitrous oxide, accounting for 29% of the sectors emissions and carbon dioxide, accounting for 27% of the sectors emissions (Gerber et al., 2013).

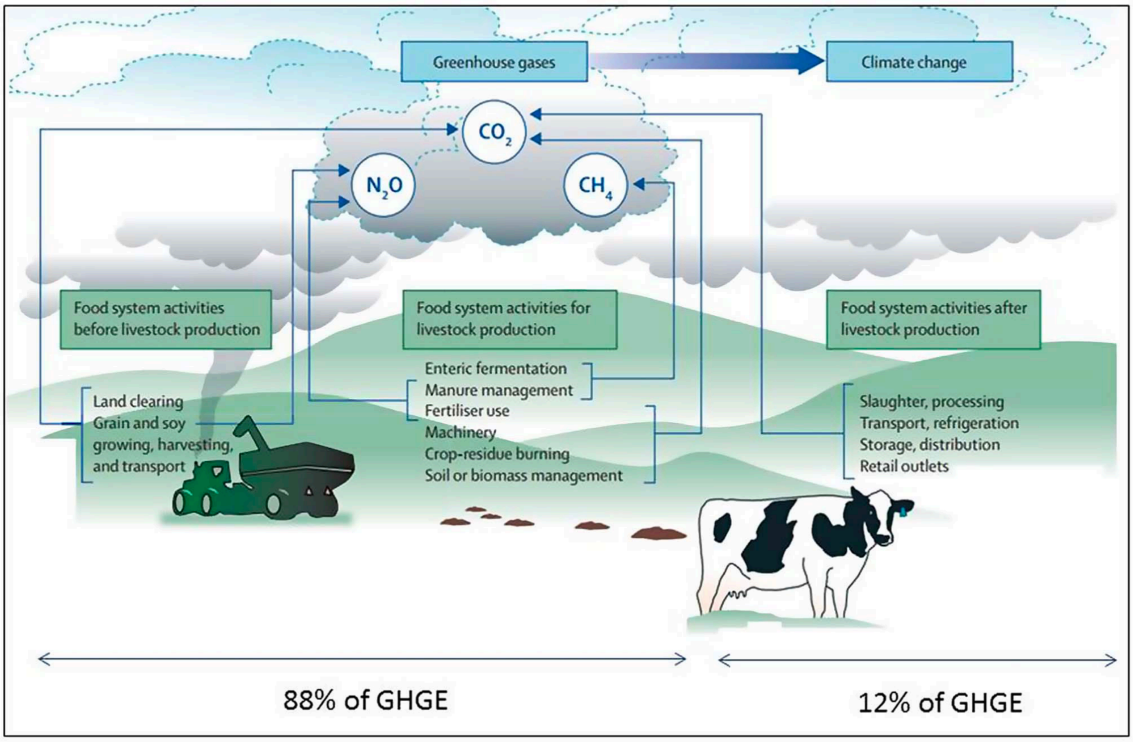
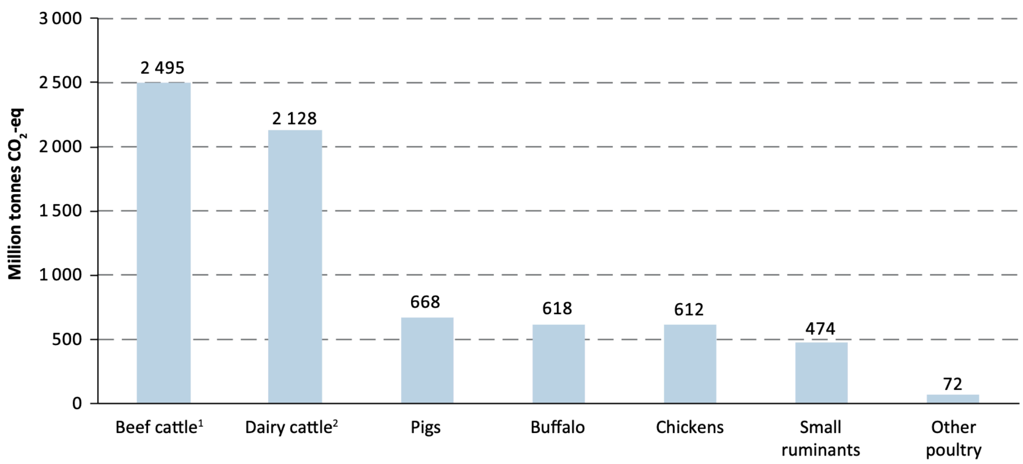


Figure 1. Sources of Greenhouse gas emissions before, during and after livestock production (from Hyland, Henchion, McCarthy & McCarthy, 2017).

It is important to note that the amount of GHGs emitted varies according to the type of livestock being raised and the type of animal product being produced (see Figure 2). For example, cattle account for 65% of emissions within the livestock sector, while pigs, poultry, buffalo and other small ruminants each account for approximately 7-10% of sector emissions (Gerber et al., 2013). In terms of commodity beef and dairy are the largest source of emissions, accounting 41% and 20% of total sector emissions respectively. Pig meat accounts for 9% of emissions; meat and milk from buffalo accounts for 8% of emissions; chicken and eggs account for 8% of emissions; meat and milk of small ruminant animals accounts for 6% of emissions; and the remaining emissions are attributed to non-edible products and other species of poultry (Gerber et al., 2013)[1]. Based on the above evidence, it can be said that the production of red meat, which includes beef, veal, pork, lamb and other small ruminant animals (e.g. Williamson, Foster, Stanner & Buttriss, 2005) is associated with substantially greater GHG emissions compared to the production of white meat, which includes poultry and rabbit (e.g. Becerra-Tomás et al., 2016). Furthermore, the production of both white and red meat emits considerably more GHGs than producing plant-based proteins. For example, GHG emissions from beef production are 250 times greater than those emitted from the production of soy products (Bailey et al., 2014). Thus, livestock production for meat and dairy is associated with significant negative environmental impacts including climate change, the degree of which varies according to the animal being reared and product being produced.



*Includes emissions attributed to edible products and to other goods and services, such as draught power and wool.
[1] Producing meat and non-edible outputs.
[2] Producing milk and meat as well as non-edible outputs.
Source: GLEAM.

[1] It should be noted that estimated greenhouse gas emissions vary according to the production system used to rear livestock as well as different methodologies used in lifecycle analysis (Bailey et al., 2014).

Figure 2. Emissions attributed to animals within the livestock sector (from Gerber, 2013).

1.4 Projected trends for meat and dairy consumption

Despite the significant negative environmental impacts associated with livestock production, diets have shown a global shift away from staple foods, towards livestock products, a transition coined 'the livestock revolution' (Delgado, Rosegrant, Steinfeld, Ehui & Courbois, 2001). Global demand for meat and dairy is on an upward trajectory in line with population growth, urbanization and increases in income, particularly in developing countries (Delgado et al., 2001; Tilman & Clarke, 2014)[2]. As such, the global consumption of meat and dairy is expected to have risen by as much as 76 and 65 percent respectively by 2050, compared to a 2005-2007 baseline (Bailey et al., 2014). An increased production of livestock will be necessary to meet rising demands for meat and dairy and it is estimated that the production of animal products would need to double by the year 2050 to meet these projected demands (Pelletier & Tyedmers, 2010). Increasing livestock production to meet rising demands is anticipated to exert additional strain on global agriculture and natural resources, as well as increasing GHG emissions, greatly exacerbating current environmental issues associated with livestock production, including climate change (e.g. FAO, 2009; Tilman and Clark, 2014).

1.5 Addressing demand for meat

It has been estimated that attempts to tackle livestock emissions through increased productivity and technical mitigation strategies will not be sufficient to even offset rising emissions associated with increasing demands for meat and dairy

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[2] It should be noted that while increased trends are shown globally, this can vary by country. For example, the UK Food and You survey found a decrease in red meat consumed in the UK; 55% of respondents ate cuts of beef, lamb and pork at least once per week in 2018, compared to 75% of respondents in 2012 (Benson, Irdam, Bulceag & Barber, 2019).

(Bailey et al., 2014). Even if all of livestock farming used the least emissions-intensive production practices available, livestock emissions would still continue to rise (Bailey et al., 2014). This is inconsistent with climate change targets, which necessitate a downward trend in agricultural emissions in order to keep global warming below 1.5-2 degrees Celsius, to avoid catastrophic and irreversible climate change (Davidson, 2012; IPCC, 2018). Furthermore, increasing productivity through intensification can generate concerns about animal welfare, as well as the increased use of antibiotics (Swain, Blomqvist, McNamara, & Ripple, 2018). On the other hand, reducing the demand for meat has the greatest potential for reducing livestock-related emissions (Bailey et al., 2014). For example, it has been estimated that sustainable intensification of the entire agricultural sector would save four gigatons of carbon dioxide equivalent per year by 2050, whereas reducing the consumption of livestock products to healthy levels in line with nutritional guidelines would reduce more than five and a half gigatons (Bajželj et al., 2014). This has led to the conclusion that shifting demand away from meat will be necessary to meet climate change targets, even with supply-side mitigation strategies (Bajželj et al., 2014; Hedenus et al., 2014; IPCC, 2018; Swain et al., 2018). Strategies for meat reduction could include reducing consumption of the most GHG-intensive meats, including red meats and beef in particular (Harwatt, Sabaté, Eshel, Soret & Ripple, 2017; Harwatt, 2018; Klöckner & Ofstad, 2017). For example, it has been estimated that substituting beef for beans in the US could offer up to 75% of GHG reduction targets (Harwatt et al., 2017). Other authors have suggested that strategies should focus on reducing red and processed meat consumption, to reduce negative environmental impact whilst improving people's health (Aston, Smith & Powles, 2012; also see section 1.6).

However, it should be noted that addressing demand for meat will not be sufficient to reach net zero emissions and should be considered alongside other emission strategies. For example, the UK Net Zero report from the Committee on Climate Change (2019) places strategies to reduce beef, lamb and dairy products, alongside strategies for increased energy efficiency, electrification of transport and heating, carbon capture and storage, development of a hydrogen economy, and changes to farming processes and land use, to achieve an estimated 95-96% reduction in GHG emissions in the UK from 1990 to 2050. It is increasingly recognised that efforts to encourage more sustainable lifestyle choices, including reducing meat consumption, reducing air travel, reducing car travel or purchasing an electric car, should supplement existing climate change strategies in order to achieve substantial reductions in GHG emissions (Dubois et al., 2019). On the other hand, adopting one pro-environmental behaviour (e.g. reducing meat consumption) can lead to the adoption of other pro-environmental behaviours (e.g. donating to environmental organisations) through a process called 'behavioural spillover' (see chapter 2, section 2.5). This is an attractive notion from a policy perspective, given that an intervention targeting one behaviour has the potential to change a suite of other pro-environmental behaviours, maximising positive environmental impact in a cost-effective way (Galizzi & Whitmarsh, 2019). Thus, it is important to consider whether interventions targeted towards changing one behaviour might also have the potential to encourage additional untargeted pro-environmental behaviours, to maximize positive environmental outcomes.

1.6 Co-benefits of meat reduction

Though differences are found according to country and commodity, recent data shows that the consumption of meat remains high in many countries (see OECD, 2020). In addition to reducing GHG emissions, encouraging dietary shifts away from meat would also be associated with different co-benefits. First, reducing meat consumption would benefit animal welfare, given that greater demand for meat increases the number of animals needed to be reared and slaughtered, resulting in more intensive production processes, greater confinement and poorer welfare standards (Bonnet, Bouamra-Mechemache, Réquillart & Treich, 2020). Moreover, reducing meat consumption would significantly benefit people's health, as most people in high-income countries currently eat high amounts of meat that exceed nutritional needs, while the overconsumption of meat, is associated with a number of negative health outcomes (Sans & Combris, 2015). This is particularly the case for red meats and meats that have been processed to improve shelf-life and flavour (Santarelli, Pierre & Corpet, 2008). For example, red and processed meat consumption has been associated with an increased risk of cardiovascular disease, stroke, type 2 diabetes, obesity and colorectal cancers (Chan et al., 2011; Micha, Michas & Mozfarian, 2012; Rouhani, Salehi-Abargouei, Surkan & Azadbakht, 2014; Yang et al., 2016). It should be noted that processed meats tend to have a greater negative impact on health than unprocessed red meats. For example, processed meats have been associated with a higher risk for coronary heart disease and type 2 diabetes compared to red meats (Micha et al., 2012). Furthermore, there is stronger evidence for the link between processed meat and colorectal cancer, leading processed meat to be classified as 'carcinogenic', while red meat is classified as 'probably carcinogenic' to humans, by the International Agency for research on Cancer (IARC, 2015).

Thus, reducing meat consumption can have positive impacts on both human health and on the environment. For example, Tilman and Clarke (2014) estimated that the global adoption of alternative diets which include little or no meat, would significantly reduce GHG emissions and land clearing, as well as incidence rates of type 2 diabetes, cancer, and mortality rates. Springmann, Godfray, Rayner and Scarborough (2016) similarly estimated that shifting towards plant-based diets in line with standard dietary guidelines would greatly reduce global mortality rates, whilst significantly reducing food-related greenhouse gas emissions. It should be noted that the impacts of dietary change vary across different countries (Springmann et al., 2016). There is evidence that most of the meat consumed in the UK is processed, contributing to an excess consumption of salt and saturated fats (Carmichael, 2019). Following this, it has been estimated that reducing meat consumption to 2-3 servings per week in the UK specifically could prevent 45,000 deaths and save the NHS £1.2billion, per year (Scarborough et al., 2010). Thus, encouraging individuals to reduce their meat intake could have significant positive impacts on the environment and on animal welfare, whilst reducing red and processed meat specifically would also have significant positive outcomes on public health and on the economy.

1.7 Public acceptability of meat reduction to mitigate climate change

Despite the need to reduce meat consumption to mitigate rising GHG emissions, plans to elicit dietary change have been absent from most climate change mitigation strategies (Wellesley et al., 2015). However, dietary changes are now beginning to emerge in climate change strategies. For example, as mentioned in section 1.5, the Committee on Climate Change (2019) include the need to reduce beef, lamb and dairy consumption in their net zero report, while the IPCC special report on global warming of 1.5^{o}C acknowledges that GHG emissions can be reduced by shifting to less resource-intensive diets including limiting meat and dairy consumption (Carmichael, 2019; IPCC, 2018). However, governments have generally tended to focus on pursuing mitigation strategies in other sectors, including energy and transport (Wellesley et al., 2015), given that strategies towards meat reduction are thought to have low political appeal and may be unpopular among the public (Laestadius et al., 2014). The overall lack of attention afforded to this issue has contributed to a lack of media attention and low public awareness regarding the impact of meat on contributing to climate change in many countries (Wellesley et al., 2015). For example, in a qualitative assessment of public awareness regarding the environmental impacts of food, Macdiarmid, Douglas and Campbell (2016) found that participants tended to be unaware and were sceptical of the link between meat consumption and climate change. Furthermore, a multinational survey conducted in 13 different countries found that participants greatly underestimated the contribution of meat and dairy consumption on climate change, while overestimating the contribution of other sectors (Bailey et al., 2014). Wellesley et al. (2015) also found that individuals in the UK were dismissive of the link between livestock production and climate change. This is problematic given that understanding of the link between meat consumption and climate change is necessary for voluntary action, while willingness to eat less meat is associated with the perceived impact on mitigating climate change (de Boer, de Witt, & Aiking, 2016; Truelove & Parks, 2012).

On the other hand, there is evidence that exposing people to information about the link between livestock production and climate change increases support for government action (Wellesley et al., 2015). There is also some evidence that increased media attention can encourage dietary change. For example, despite a global increase in meat and dairy consumption (e.g. Delgado et al., 2001; Tilman & Clarke, 2014), there is evidence to suggest a decreased consumption of red meat (beef, lamb and pork) in the UK (Benson, Irdam, Bulceag & Barber, 2019). Ritchie (2019) suggests that this decline in consumption could result from media campaigns aimed towards meat reduction, such as 'Meat-Free Mondays', a campaign to avoid eating meat each Monday (see meatfreemondays.com), and 'Veganuary', a campaign to eat a vegan diet throughout January (see uk.veganuary.com). However, this is speculative, and it is not clear whether the popularity of such campaigns is the result or cause of reduced meat consumption in the UK (Benson et al., 2019). Thus, the evidence suggests that individuals tend to show a relatively low awareness and willingness to reduce their meat consumption as a climate change mitigation strategy. On the other hand, providing information and increasing awareness of the climate impacts of meat can increase public acceptability and willingness to eat less meat.

1.8 Overview of this thesis

This thesis seeks to address three main aims. First, this thesis aims to investigate in depth the motives driving meat consumption, the motives driving meat reduction and awareness of the negative environmental impacts of meat, among individuals who include and exclude meat from their diet. Second, this thesis aims to test the effectiveness of providing information on the environmental, health, or combined information on the environmental and health impacts of meat, on reducing red and processed meat consumption, whilst also investigating what foods might be used to replace red and processed meat. This thesis focusses on reducing red and processed meat specifically, given that red and processed meats have a greater negative impact on the environment and on human health, compared to white meat. Third, this thesis aims to investigate whether reduced red and processed meat consumption might lead to an increased willingness to perform additional pro-environmental behaviours through behavioural spillover, as well as investigating the underlying factors that might cause such an effect. These aims are addressed through two studies using a sequential qualitative-quantitative design, including qualitative interviews, as well as quantitative surveys and food diaries, with different participant samples.

It should be noted that the extent to which individuals reduce their meat consumption can vary substantially. Broadly speaking, *vegetarian* diets exclude meat, fish and poultry; *vegan* diets exclude meat, fish, poultry and any other animal products such as eggs and dairy; and *pescatarian* diets exclude meat and poultry but include fish (Corrin & Papadopoulos, 2016). Other options include a *semi-vegetarian, flexitarian or plant-based diet*, used to describe diets that are mostly vegetarian but sometimes include meat or fish (Corrin & Papadopoulos, 2016)[3]. In addition to these definitions, this thesis uses *meat reduction* to describe the reduced consumption of meat, to any degree. *Meat-free* diets is also used, to describe any diet that excludes meat (i.e. vegetarian and vegan diets). The outline for the remainder of this thesis is as follows:

Chapter 2 reviews existing literature on the different motives thought to drive diets that include and exclude meat, as well as the potential barriers towards meat reduction. The usefulness of psychological theories and models to understand behaviour change is discussed with applications towards understanding meat reduction. The potential for informational strategies to elicit behaviour change,

[3] It should be noted that these terms are not always used consistently throughout the literature, e.g. vegetarian is sometimes used to also describe semi-vegetarian or vegan diets. Plant-based diets have also been used to describe vegetarian and vegan diets (e.g. Springmann, Charles, Godfray, Rayner, & Scarborough 2016). This thesis adheres to the definitions provided by Corrin and Papadopoulus (2016) for clarity.

including meat reduction, and to encourage other pro-environmental behaviours through spillover is also discussed. Relevant empirical evidence is evaluated and gaps in the literature are highlighted throughout. Chapter 2 concludes with a more detailed outline of the aims addressed in this thesis.

Chapter 3 outlines qualitative and quantitative research approaches, including the epistemological and ontological position associated with each method, as well as longstanding debates surrounding the perceived usefulness of each approach. The merits of combining qualitative and quantitative methods within a mixed-methods approach are discussed, and justification for the use of a sequential qualitative-quantitative mixed-methods design within this thesis is provided. Chapter 3 concludes with an outline of the methods, measures and procedures used in this thesis.

Chapter 4 describes the results of the first study of this thesis. Qualitative semi-structured interviews are used to explore in-depth the motives driving meat consumption, the motives driving meat reduction and awareness of the environmental impacts of meat. Where the findings of this study were used to inform the development of the second study presented in this thesis is also discussed.

Chapter 5 reports on baseline data conducted as part of the second, quantitative study of this thesis. Quantitative surveys are used to investigate participants' willingness to reduce their red and processed meat consumption, drawing from key psychological models of behaviour change: the Theory of Planned Behaviour and the Transtheoretical Model.

Chapter 6 reports on the results of a randomised messaging intervention that was implemented as part of the second, quantitative study of this thesis. Quantitative surveys and food diaries are used to compare differences in red and processed meat consumption during the intervention and one month later, compared to baseline. Changes in the consumption of white meat, fish and plant-based products during the intervention period are also investigated as potential replacements for red and processed meat.

Chapter 7 also reports on the results of the second, quantitative study in this thesis. Survey data is used to investigate relationships between changes in red and processed meat consumption and participants' willingness to perform untargeted pro-environmental behaviours. Potential mediating and moderating variables are also explored.

Chapter 8 synthesises the empirical findings of both studies presented in this thesis. Findings are discussed in relation to existing literature as well as implications towards strategies aimed at meat reduction. The strengths and limitations of this thesis are discussed and future areas of research are suggested.

Chapter 2: Literature Review

2.1 Introduction

This chapter provides an overview of the literature, including the motives found to drive meat consumption and meat reduction, the usefulness of different psychological theories and models to understand behaviour change, the effectiveness of informational strategies to encourage behaviour change, and the potential for strategies to elicit pro-environmental behavioural spillover. The remainder of this chapter is divided into five main sections.

Section 2.2 focuses on the motives driving meat consumption and potential barriers towards meat reduction. This section also focuses on the motives for meat reduction, including the motives for meat-free diets. Gaps in the literature relating to past investigations of motives for meat reduction are identified.

Section 2.3 describes psychological determinants of behaviour change as indicated by two prominent models of behaviour change: the Transtheoretical Model (Prochaska & Velicer, 1997) and the Theory of Planned Behaviour (Ajzen, 1991). The potential usefulness of these models in explaining people's willingness to reduce their meat consumption is discussed, as well as the utility of combining these models to provide a comprehensive explanation of behaviour change, with supporting evidence from recent literature.

Section 2.4 discusses information provision as a strategy for reducing meat consumption, with a focus on environmental and health messages. Empirical evidence supporting the effects of environmental and health messages on encouraging meat reduction is evaluated and areas warranting further investigation are identified. The different factors that can influence the persuasiveness of information on eliciting behaviour change are also discussed. The types of foods that might be used to replace meat in the diet following a successful intervention aimed at meat reduction are also considered and gaps in the literature are identified.

Section 2.5 describes the potential for strategies aimed at meat reduction to encourage an increased or decreased willingness to perform other pro-environmental behaviours, through positive or negative behavioural spillover, respectively. Recent literature investigating behavioural spillover following interventions aimed at reducing meat consumption is reviewed. Different factors thought to underpin positive and negative behavioural spillover are also discussed.

Section 2.6 presents the aims of this thesis, based on the literature reviewed in this chapter.

2.2 Motives driving meat consumption and meat reduction

2.2.1 Motives driving meat consumption and barriers to reduction

A useful first step to understanding how to encourage meat reduction is to understand the motives driving meat consumption. As indicated by the previous chapter, high-income Western diets tend to be characterised by an overconsumption of meat that exceeds dietary needs (Sans & Combris, 2015; Westhoek et al., 2014). This can be explained by the fact that meat consumption is embedded within many social and cultural values and practices. For example, meat consumption is associated with ideas of power, masculinity and wealth, whilst also being embedded within social norms and traditions (Lentz, Connelly, Mirosa & Jowett, 2018; Soret, & Sabate, 2014). Meat consumption is a common practice in Western countries, such that it is strongly routinised and plays a fundamental role in meal structure (Douglas, 1972; Lentz et al., 2018; Riley, 2010). For example, a recent UK survey found 81% of respondents ate meat at least once per week (Benson et al., 2019). Additionally, meat is seen as being tasty and healthy (Ruby, 2012). It is believed to be an important source of nutrients, leading many individuals believe that meat is essential to a healthy diet (Piazza et al., 2015; Verbeke, Pérez-Cueto, Barcellos, Krystallis, Grunert, 2010). Indeed, meat consumption is seen by many as being natural, normal, necessary, and nice (Piazza et al., 2015). As such, individuals can feel an affective connection and attachment towards meat and a reluctance to change one's dietary habits (Graça, Calheiros & Oliveira, 2015). Indeed, meat consumption is embedded within society in such a way that, for many, it is not seen as a morally troublesome behaviour (Loughnan, Haslam & Bastian, 2010). These driving factors help to explain the so called 'meat-paradox'; the desire to eat meat despite a moral response to animal suffering (Loughnan et al., 2010).

Unsurprisingly, the factors driving meat consumption also act as barriers towards meat reduction. For example, previous literature has found that individuals tend to be reluctant to reduce their meat consumption because it is viewed as being natural, pleasurable, socially acceptable, and traditional (Macdiarmid et al., 2016).

The perceived health benefits of meat and concerns that a diet low in meat would lack certain nutrients, prevents individuals from reducing their consumption (Piazza et al., 2015). Furthermore, individuals tend to be unwilling to change their eating habits (Graça et al., 2015; Lea & Worsley, 2003). Convenience, price and a lack of knowledge about vegetarian diets have also been identified as barriers towards meat reduction (Lea & Worsley, 2003; Vainio, Niva, Jallinoja & Latvala, 2016). Thus, meat consumption is culturally ingrained and various barriers might lead individuals to be reluctant to change their dietary habits.

2.2.2 Motives driving diets that reduce or exclude meat

Despite the apparent appeal of meat, many individuals actively decide to reduce or exclude meat from their diet. For example, the National Diet and Nutrition Survey showed in their 2012 report that approximately 1.2 million individuals in the UK, or 2-3% of the population, followed a vegetarian diet (Vegetarian Society, 2019). More recently, the UK Food and You survey similarly showed that 3% of respondents followed a vegetarian diet while 1% followed a vegan diet (Benson et al., 2019). The Food and You survey also found a 25% decrease in the number of respondents who indicated that they ate cuts of beef, lamb and pork at least once per week in 2018, compared to 2012 (Benson et al., 2019). This is in line with evidence that, while meat consumption is increasing in many developing countries (see chapter 1, section 1.4), some developed countries have seen decreases in meat consumption over the last decade (The Vegan Society, 2019).

Investigating the reasons underpinning people's decisions to reduce or exclude meat from their diet can be useful for identifying potential motives to encourage meat reduction among meat-eaters. For example, in an in-depth qualitative investigation of the motivations driving vegan and vegetarian diets, Fox and Ward (2008a, 2008b) found that respondents most often cited health benefits, concern for animal welfare, spirituality and to a lesser extent, environment issues, as motives for pursuing a meat-free diet. Furthermore, in a review of the literature investigating motivations for adopting a vegetarian diet, Ruby (2012) similarly found that vegetarian diets tended to be motivated by moral concerns relating to the raising and slaughter of animals, concern for health, environmental issues, spiritual purity, and disgust towards properties of meat. Additional research has found health, animal welfare, environmental factors, personal norms, detachment towards meat and disgust, to be associated with meat reduction (Dagevos & Voordouw, 2017; Graça et al., 2015; Latvala et al., 2012; Verbeke & Vackier, 2004).

However, past literature has focussed on the motives of those who have already excluded meat from their diet, without investigating the motives that would encourage regular meat-eaters to reduce their meat consumption (Harguess et al., 2020; Zur & Klöckner, 2014). This has led to a lack of knowledge regarding the potential motivating factors and barriers towards meat reduction (Zur & Klöckner, 2014). This is concerning, given evidence that the motives encouraging reduced meat consumption can differ across consumer groups. For example, Lentz, et al. (2018) found that standard meat-eaters would be motivated by health and price to reduce their meat consumption, while those who had already reduced or excluded meat from their diet were motivated by issues relating to animal welfare and the environment. De Backer and Hudders (2014) similarly found that vegetarian diets tended to be motivated by concern for animal welfare and the environment, while semi-vegetarian diets, in which participants reduced their meat consumption to a lesser extent, tended to be motivated by health concerns. Moreover, de Boer, Scholser and Aiking (2017) found that vegetarian participants were motivated by dislike of meat and concern for animal welfare, while those who consumed low to medium amounts of meat were motivated by health. Thus, the literature suggests that different factors might be relevant for motivating meat-reduction among individuals with different diets.

The above literature suggests that focussing on issues relating to animal welfare or the environment might not be effective in encouraging regular meat-eaters to reduce their meat consumption. Indeed, while environmental issues have appeared as a motivating factor for vegetarian and vegan diets, past literature has indicated that many individuals are unwilling to reduce their meat consumption for environmental reasons (e.g. Austgulen, Skuland, Schjøll, & Alfnes, 2018; Macdiarmid, et al., 2016; Tobler, Visschers & Siegrist, 2011). Thus, there is a need to further investigate the factors that would encourage regular meat-eaters to limit their meat consumption, given that this would be the target population for strategies aimed at encouraging meat reduction. The first study presented in this thesis aims to fill this gap, by investigating the motives that would encourage meat-eating participants to reduce their meat consumption, as well as the motives encouraging meat-reduction among self-identified vegetarians and vegan participants. This study also aims to investigate participants' awareness of the negative environmental impacts of meat, given that individuals tend to be unaware of this link (e.g. Bailey et al., 2014; Macdiarmid, et al., 2016), while environmental motives are often cited as a motivation for vegetarian and vegan diets, as noted above (e.g. De Backer & Hudders, 2014; Lentz et al., 2018).

2.3 Psychological determinants of behaviour change

Behaviour change models can also shed light on the factors underlying decisions to eat less meat. For example, the Transtheoretical Model (TTM) can be used to understand a person's readiness to reduce their meat consumption, while the Theory of Planned Behaviour (TPB) can be used to explain psychosocial factors underpinning intentions to eat less meat.

2.3.1 The Transtheoretical Model (TTM)

The TTM (Prochaska & Velicer, 1997) is a comprehensive framework conceptualizing when and how behavior change occurs. Although it was originally developed to investigate smoking cessation, the TTM has also been applied to a number of different health and pro-environmental behaviours (e.g. Friman, Huck & Olsson, 2017; Liu, Kueh, Arifin, Kim & Kuan, 2018) and has also been applied to investigate meat reduction (e.g. Lea, Crawford & Worsley, 2006). The TTM provides a temporal understanding of behaviour change, focussing on a person's readiness to change from an undesirable behaviour to a desirable one. Rather than viewing behaviour change as a discrete event, the model posits that change occurs through a series of six distinct *stages of change*: 1) precontemplation, 2) contemplation, 3) preparation, 4) action, 5) maintenance and 6) termination (Prochaska & Velicer, 1997). The *precontemplation* stage describes people who do not intend to change their behaviour. People may be in this stage because they lack awareness about the consequences of the problem behaviour, or they might have attempted and failed to change their behaviour previously. Individuals in this stage tend to avoid reading, thinking or talking about the problem behaviour. In the *contemplation* stage, people consider changing their behaviour in the future, but have not yet made any attempts to do so. In the *preparation* stage people intend to change their behaviour in the near future and might take small steps towards doing so, for example by buying a self-help book. In the *action* stage, people have already made a change to their behaviour. In the *maintenance* stage, people have maintained the new behaviour for a prolonged period of time, are less tempted to indulge in their problem behaviour and are more confident in their ability to maintain it. Another stage of change is *termination*, whereby individuals are not tempted to engage in the previous problem behaviour and have a high self-efficacy that they will never engage in the previous problem behaviour, regardless of the circumstances. However, termination has received markedly less attention compared to the other stages of change and is generally not included in studies on the TTM. This is because many problem behaviours involve a high prevalence of relapse and temptation; thus, a more realistic goal is to reach the action or maintenance stage, rather than termination.

The stages of change are useful in identifying a person's readiness to adopt a new behaviour, meaning that behaviour change interventions can be tailored to the needs of that individual to maximise their effect (Krebs, Prochaska & Rossi, 2010). Studies applying the TTM towards the adoption of plant-based diets or 'green-eating' (part of which includes reduced meat consumption) have indicated that individuals tend to show a low readiness to change, with the majority of participants often falling into the precontemplation stage of change (Lea et al.,2006; Weller et al., 2014). A study applying a stage-based model similar to the TTM also found that the majority of participants were in the pre-action stage (similar to precontemplation) with regards to reducing their beef consumption (Klöckner & Ofstad, 2017). Given that individuals appear to be in the precontemplation stage, providing information on *why* an individual should reduce their meat consumption might be an effective strategy for encouraging behaviour change, rather than focussing on how to reduce one's consumption for example (Klöckner & Ofstad, 2017).

Although the stages of change are the main focus of the TTM, the model also includes a series of other constructs which describe the cognitive, emotional and behavioural processes thought to occur during behaviour change. In particular, self-efficacy and decisional balance are used to explain progression through the different stages of change. Self-efficacy is taken from Bandura's self-efficacy theory (Bandura, 1977) and relates to the amount of confidence a person has in their ability to perform the behaviour in question (Velicer, Diclemente, Rossi, & Prochaska, 1990). Self-efficacy focuses on internal factors, such as the extent to which a person views performing the behaviour as being easy or difficult (Parkinson, David, & Rundle-Thiele, 2017). According to the TTM, self-efficacy increases with stage progression so that it is higher in the later stage of change, particularly in action and maintenance (DiClemente, Prochaska & Gibertini, 1985). Temptation reflects the converse and describes the urge to engage in a problem behaviour when in difficult situations, such as those involving emotional distress, certain social situations, and craving (Prochaska & Velicer, 1997). Thus, self-efficacy predicts the maintenance of a behaviour whereas temptation predicts relapse (DiClemente et al., 1985; Velicer, Diclemente, Rossi & Prochaska, 1990).

Decisional balance relates to the relative weighting of the perceived 'pros' and 'cons' associated with changing a behaviour. According to the TTM, the cons of changing a behaviour outweigh the pros in earlier stages of change, while the pros outweigh the cons in later stages. This cross-over takes place at the contemplation stage, so that the cons are higher than the pros in precontemplation, the pros and cons are equal in contemplation, and the cons are lower than the pros in preparation and action (Prochaska, 1994). The model specifically predicts that progression from precontemplation to action is associated with approximately 1 standard deviation increase in the perceived pros of a behaviour and 0.5 standard deviation decrease in the cons (Prochaska, 1994). Thus, according to the TTM, behaviour change occurs when the perceived pros of changing a behaviour increase twice as much as the cons decrease. This pattern of results has been supported for a number of different health-related behaviours (e.g. Hall & Rossi, 2008) including dietary behaviours (Noia & Prochaska, 2010). There is also some evidence to support increased perceived pros and decreased cons across the different stages, with regards to eating a plant-based diet and 'green-eating' behaviour (Lea et al., 2006; Weller et al., 2014). Weller et al. (2014) also found evidence to support an increased self-efficacy across the different stages of change, in relation to 'green-eating'. However, in general most studies have focussed on the stages of change, without investigating decisional balance or self-efficacy (Casey, Day & Howells, 2005).

Thus, the TTM provides a comprehensive framework for explaining behaviour change with a focus on a person's readiness to change their behaviour assessed through the different stages of change. However, although different socio-cognitive factors are included in the TTM, few studies have examined the complete model and most only include the stages of change (Casey et al., 2005). On the other hand, the role of other psychosocial factors to encourage progression from the precontemplation to the action or maintenance stage can also be examined by drawing on other theories and models of behaviour change, to provide a more comprehensive account of behaviour change (e.g. Wyker & Davidson, 2010). In particular, the TTM can be integrated with the TPB, to investigate the relative impact of different psychosocial constructs on behaviour change for individuals in the different stages of change.

2.3.2 The Theory of Planned Behaviour (TPB)

The TPB (Ajzen, 1991) is a well-established model that explains behaviour through specific psychosocial constructs. In fact, it is one of the most commonly used models to explain the gap between people's attitudes and behaviours, by supposing that attitude is just one determinant of behaviour (Armitage & Conner, 2001). As such, the TPB has been applied to various health (see McDermott et al., 2015) and pro-environmental behaviours (see Steg & Vlek, 2009), including meat reduction (e.g. Carfora, Caso & Connor, 2017a, 2017b; Graca, et al., 2015; Povey, et al., 2001). According to the TPB, the most important determinant of behaviour is behavioural intention, which is in turn predicted by a person's attitude towards performing the behaviour, in addition to their subjective norms associated with the behaviour, and their perceived behavioural control over it (Ajzen, 1991). Attitude refers to the degree to which a person evaluates the behaviour positively or negatively, subjective norm refers to a person's perceived social pressure to perform the behaviour from significant others, while perceived behavioural control refers to a person's perceived ability to perform a behaviour with a focus on external factors, such as the perceived opportunities to perform the behaviour considering the person's environment (Ajzen, 1991). The addition of perceived behavioural control to the model distinguishes it from the previous model, the Theory of Reasoned Action (Fishbein & Ajzen, 1975).

The above constructs describe 'global measures' that directly relate to the behaviour in question. According to the TPB, these global measures are in turn determined by certain beliefs, namely, behavioural beliefs, normative beliefs and control beliefs (Ajzen, 1991; Ajzen & Driver, 1991). For example, attitude is determined by behavioural beliefs, relating to the outcomes or attributes of performing that behaviour. A person who believes performing a behaviour will lead to positive outcomes will have a more positive attitude towards it, while a person who believes that the behaviour will lead to negative outcomes will have a negative attitude towards it. Similarly, subjective norms are determined by normative beliefs, referring to whether individuals close to the person approve or disapprove of that behaviour. A person will hold a positive subjective norm when they perceive that others will approve of the behaviour in question, and a negative subjective norm when they perceive that others will disapprove it. Finally, perceived behavioural control is determined by control beliefs, relating to the perceived presence or absence of factors that would facilitate or hinder one’s ability to perform the behaviour and the perceived impact these would have. A stronger perceived behavioural control would be associated with the perceived presence of facilitating factors and perceived absence of inhibiting ones, in relation to the behaviour. In addition to predicting intentions, perceived behavioural control also predicts behaviour directly, especially when perceived control over the behaviour is accurate (Ajzen, 1991).

Some studies have applied the TPB to predict intentions to reduce meat consumption, with mixed results. For example, some authors found attitudes to be the only significant predictor of intentions to eat less meat (e.g. Zur & Klöckner, 2014; Lentz, et al., 2018), while others have found perceived behavioural control and subjective norms to also be significant predictors (e.g. Graca et al., 2015; Povey et al., 2001; Wyker & Davidson, 2010). Thus, there is scope for further research in this area, to establish more firmly the relative influence of the different TPB variables on predicting intentions to eat less meat.

2.3.3 Self-Identity as a TPB construct

There is a body of literature supporting the predictive ability of the TPB in relation to a range of different behaviours (see Armitage & Conner, 2001 for a review). However, the variance explained in behavioural intention by attitudes, subjective norms and perceived behavioural control varies on average from 28-40% (Rise, Sheeran & Hukkelberg, 2010). This has led some authors to question whether the model captures all determinants of behavioural intention (Rise et al., 2010). Indeed, Azjen (1991) argues that additional predictors could be included in the TPB to increase the explained variance in intention. It has been noted that subjective norms are a particularly weak predictor of intentions (e.g. Armitage & Conner, 2001; Rivis & Sheeran, 2003), which has led some authors to also include descriptive norms, i.e. referring to how other people are perceived to act, rather than how one perceives they *should* act (Cialdini, Kallgren & Reno, 1991) within the model (e.g. Armitage & Conner, 2001; Rivis & Sheeran, 2003). Furthermore, there is evidence that behavioural intentions do not always predict behaviour (Hassan, Shiu & Shaw, 2016). Following this, medium to large change in intentions have been found to have only a small to medium effect on changing behaviour (Webb & Sheeran, 2006). This has led to the inclusion of other variables in the TPB to increase its predictive ability. Specifically, particular attention has been afforded to the role of self-identity, which has become a well-recognised additional predictor in the TPB (Rise et al., 2010), able to explain additional variance in both intentions and behaviour (Armitage & Conner, 2001).

Self-identity refers to a salient and lasting aspect of one's self-perception, where the self is a social construct that can be associated with different roles in different contexts (Rise et al., 2010; Sparks, 2000). Each categorization of the self is associated with internalised expectations about role-appropriate behaviour and an increased intention to perform relevant behaviours (Charng, Piliavin & Callero, 1998; Stryker, 1968). People are motivated to act in ways that are consistent with their identity to maintain and affirm their sense of self, especially when a particular role and/or identity is made salient (Stets & Burke, 2000). Identity is particularly relevant for meat-eating behaviour (de Boer et al., 2017; Povey et al., 2001), given that eating meat can signal aspects of the self, including power, masculinity and wealth (see section 2.2). Thus, it is possible that identifying strongly as a meat-eater might have a powerful influence on behaviour regarding meat consumption and meat reduction. Indeed, past research has demonstrated that meat-eater identity positively predicts intentions to eat meat (e.g. Povey et al., 2001) and negatively predicts intentions and willingness to reduce one's meat consumption (e.g. Carfora et al., 2017b; De Groeve, Bleys & Hudders, 2019).

Other types of self-identity are also relevant to meat-eating behaviour, given that meat consumption has different impacts on the environment and on health. For example, Whitmarsh and O'Neill (2010) found that 'green identity' significantly predicted pro-environmental shopping and eating, including reduced meat consumption. Pro-environmental identity, specifically, energy-saving identity, has also been found to positively predict intentions to eat less meat (Van der Werff, Steg & Keizer, 2013). Other studies have also investigated health identity as a predictor of meat reduction. However, while meat consumption is associated with different health outcomes, past studies found that health-identity was not a significant predictor of intentions to reduce one's meat consumption (Carfora et al., 2017b; Povey, et al., 2001). Beyond this, very few studies have investigated the role of self-identity in predicting intentions to reduce one's meat consumption (Carfora et al., 2017b). Thus, existing literature highlights the importance of considering the potential influence of self-identity on intentions to reduce one's meat consumption, as different identities have the potential to facilitate (e.g. pro-environmental identity) or hinder (e.g. meat-eater identity) meat reduction. Based on this, the second study presented in this thesis combines identity within the TPB to investigate intentions to reduce red and processed meat consumption.

2.3.4 Combining the TPB and TTM

It has been established that the TTM and TPB can be combined to provide a more comprehensive account of behaviour change, with many studies combining these models to explain environmental and health behaviour (e.g. Courneya, & Bobick, 2000; Forward, 2014). Specifically, the models can be combined to investigate differences in psychosocial factors associated with behaviour as identified by the TPB, across the TTM's stages of change. Identifying differences in psychosocial factors across the different stages provides insight into how a person's readiness to change their behaviour might be associated with changes in other psychosocial factors, e.g. attitudes, perceived behavioural control. Thus, the TTM and TPB can be combined to provide a comprehensive understanding of people's readiness and willingness to reduce their meat consumption. This information can then be used to promote behaviour change through tailored interventions.

Some recent studies have applied the TTM and TPB to explain reduced meat consumption. For example, Wyker and Davison (2010) combined the TTM and the TPB to investigate decisions to adopt a plant-based diet. They found that attitudes, intentions, normative beliefs, and perceived behavioural control significantly increased from precontemplation to contemplation, and that attitudes and intentions also significantly increased from contemplation to preparation. However, differences between preparation and action were not assessed in this study. Similarly, Weibel, Ohnmacht, Schaffner and Kossmann (2019) combined the TPB with the self-regulation model, a phase model similar to the TTM, to investigate decisions to eat less meat. They found that later stages (e.g. similar to action) were associated with more positive attitudes, as well as stronger social norms and perceived behavioural control. However, intentions to eat less meat were not assessed in this study. Thus, there is some evidence to suggest that an increased readiness to reduce one's meat consumption is associated with an increase in intentions, attitudes, social norms and perceived behavioural control, although differences are not always found between all of the stages. It should be noted that beyond this, few studies have combined the TPB and TTM to explore people's willingness to reduce their meat consumption. The second study presented in this thesis aims to add to this literature, by combining the TTM and TPB to understand people's willingness to reduce their red and processed meat consumption.

2.4 Information provision as a strategy for reducing meat consumption

2.4.1 Strategies to reduce meat consumption

Investigating psychological determinants of behaviour can provide a useful base for understanding the motives associated with an increased or decreased willingness to reduce one's meat consumption. However, it is also important to consider how individuals might be persuaded to reduce their meat consumption, to inform strategies aimed at encouraging dietary change. As such, there has been a rise in intervention studies aimed at encouraging more plant-based and less animal-based diets over recent years (Taufik, Verain, Bouwman & Reinders, 2019). The majority of behavioural interventions have focussed on promoting plant-based diets, mainly through increased fruit and vegetable consumption, rather than targeting the consumption of meat or other animal-based foods (Taufik et al., 2019). On the other hand, studies investigating interventions to reduce meat consumption have focussed on reducing intentions or willingness to eat meat, rather than reducing meat consumption (Bianchi, Dorsel, Garnett, Aveyard & Jebb, 2018; Harguess, Crespo & Hong, 2020).

Different strategies have been employed with the goal of encouraging reduced meat consumption. In their review of the literature, Bianchi et al. (2018) found evidence that using self-monitoring and individual lifestyle counselling can be effective in reducing meat consumption (e.g. Carfora et al., 2017a, 2017b; Hawkes, Gollschewski, Lynch & Chambers, 2009; Hawkes, Patrao, Green & Aitken, 2012). They also found that providing information on the health and environmental impacts of meat can lead to reduced intentions to eat meat, however there was no evidence that this might lead to changes in meat-eating behaviour (e.g. Cordts, Nitzo & Spiller, 2014). In another review of past strategies to reduce meat consumption, Harguess et al. (2020) found evidence that evoking emotions through animal imagery can be effective in reducing willingness to eat meat, and that changing the food environment can increase hypothetical meat-free meal choices (e.g. Campbell-Arvai, Arvai & Kalof, 2014; Zickfeld, Kunst, & Hohle, 2018). They also found evidence that increasing knowledge and skills can be effective in reducing intentions to eat meat, with some studies also demonstrating the effects of interventions on reducing meat consumption (e.g. Loy, Wieber, Gollwitzer & Oettingen, 2016). Therefore, there is a growing literature investigating different strategies to increase plant-based diets and to reduce meat consumption. However, many studies have investigated the effects of interventions on influencing behavioural intentions, rather than behavioural change.

2.4.2 Information provision as a strategy for behaviour change

Information provision is one of the most widely used intervention techniques to promote behaviour change and is generally based on the assumption that people do not behave in certain ways (e.g. in environmentally friendly ways), because they lack awareness (e.g. of environmental issues; Abrahamse & Matthies, 2019). On the other hand, providing information can help overcome this knowledge-deficit, resulting in relevant behaviour change (Schultz, 2002). Information provision is a therefore a particularly relevant strategy for meat reduction, given that there is currently an awareness gap regarding the impact of meat production on climate change, while this lack of awareness is thought to fuel further inaction towards meat reduction (see chapter 1, section 1.5). Furthermore, studies applying the TTM indicate that many individuals have not considered reducing their meat consumption (e.g. Lea et al.,2006; Weller et al., 2014), while providing information can increase participants' willingness and readiness to reduce their consumption (e.g. Klöckner & Ofstad, 2017). As such, information provision is a popular intervention technique used in studies aimed at encouraging reduced meat consumption (Harguess et al., 2020).

However, it should be noted that some researchers have questioned the effectives of information provision on reducing meat consumption given that it is so deeply embedded within social and cultural practices (Edjabou & Smed, 2013). Nevertheless, other potential mitigation strategies thought to be more effective, such as price-based strategies (Edjabou & Smed, 2013), face other challenges. For example, taxation would have a negative impact on the food security of those from lower income households (Apostolidis & McLeay, 2016). Furthermore, imposing a meat-tax might would have high monitoring costs and would be unpopular among the general public as well as meat-producers and politicians (Apostolidis & McLeay, 2016; Edjabou & Smed, 2013). On the other hand, information campaigns provide a low-cost strategy that is more publicly acceptable (Bicket & Vanner, 2016).

Furthermore, information campaigns can lead to an increased acceptability of other strategies for meat reduction (e.g. Dagevos & Voordouw, 2013; Graham & Abrahamse, 2017; Stea & Pickering, 2017; Wellesley et al., 2015). This has led to conclusions that information campaigns would be an essential first step in increasing the effectiveness of subsequent interventions aimed at meat reduction (Wellesley et al., 2015). This thesis focusses on informational strategies to reduce meat consumption for these reasons.

2.4.3 Communicating the environmental and health impacts of meat

Intervention studies aimed at meat reduction have demonstrated that information provision can be effective in reducing intentions to eat meat, with a limited number of studies also demonstrating their effect on reducing meat consumption (see Bianchi et al., 2018; Harguess et al., 2020). Following this, there is some evidence to support that communicating the negative environmental impacts of meat can be effective in increasing intentions to reduce ones' meat consumption (e.g. Graham & Abrahamse, 2017; Hunter & Röös, 2016; Stea & Pickering, 2019). However, some authors have shown concern over the effectiveness of raising awareness of the negative environmental impacts of meat on eliciting behaviour change, given that individuals tend to be unaware and can be sceptical of this link (e.g. Macdiarmid et al., 2015; Wellesley et al., 2015).

In addition to mitigating rising greenhouse gas emissions and the overuse of natural resources, reducing meat consumption is associated with different co-benefits, on animal welfare, public health, and the economy (see chapter 1, section 1.6). As such, some authors have suggested that strategies would benefit from focussing on the co-benefits of meat reduction, specifically the health benefits of eating less meat, to maximize their effectiveness on encouraging behaviour change (Wellesley et al., 2015). In fact, there is some evidence that focussing on the negative health impacts of meat might be a more effective strategy in encouraging individuals to reduce their meat consumption than focussing on the negative environmental impacts. For example, Jagers, Linde, Martinsson and Matti (2017) found that twice as many respondents indicated that health motivated them to avoid buying meat, compared to the number of respondents who avoided buying meat for environmental reasons. Moreover, Cordts et al. (2014) found that information highlighting the impacts of meat on health was more effective in increasing intentions to reduce meat consumption compared to information related to the impact of meat on climate change. This is in line with recent literature emphasising the role of health outcomes in motivating pro-environmental behaviour. For example, Amelung et al. (2019) argue that focussing on the health rather than environmental impacts of a behaviour is more effective at encouraging pro-environmental behaviour, given that acting in a healthy way has a direct impact on the individual, whereas acting in a pro-environmental way has an indirect influence, that is often contingent on the actions of others.

On the other hand, it is possible that multiple arguments can be combined to encourage pro-environmental behaviour, given that pro-environmental behaviours, including decisions to reduce one's meat consumption, can be driven by a number of different motivations (e.g. Jagers et al., 2017). Recent studies have begun to investigate the effectiveness of combined informational strategies on meat reduction, with some mixed results. For example, Amiot, Boutro, Sukhanova and Karelis (2018) tested the effect of a multi-component intervention, which included the provision of information highlighting the impacts of meat on people's health, the environment and animal welfare, as well as other components such as an appeal to fear and mind attribution task, on reducing meat consumption among Canadian male participants. They found no differences two weeks after the information was received, however four weeks afterwards, intervention participants ate significantly less meat than those in the control group. Carfora, Catellani, Caso and Conner

(2019a[4]) more recently compared the effects of providing information on either the health, environmental, or the combined health *and* environmental, impacts of meat, on reducing participants' red and processed meat consumption as part of a randomised messaging intervention study in Italy. They found that providing information on either the health or the environmental impacts of meat was effective in reducing participants' red and processed meat consumption shortly after the intervention period and one month later, while providing information on the combined health and environmental impacts of meat had no effect. On the other hand, Carfora, Bertolotti and Catellani (2019b) found that combining information on the health and environmental impacts of meat was effective in reducing participants' red and processed meat consumption immediately after a randomised messaging intervention compared to a control group, while those who received this information with a focus on anticipated regret also reduced their red and processed meat one month later. Thus, there is some evidence that providing information on the health and environmental impacts of meat can be effective in reducing people's meat consumption. On the other hand, there is some mixed evidence with regards to the effectiveness of combining information on both the health and environmental impacts of meat and the timeframe in which dietary change might occur.

It is important to note that many of the studies discussed so far have investigated the effects of providing information on attitudes or intentions, with fewer studies investigating the effects of information on reducing people's meat consumption. For example, a recent review of experimental studies aimed at meat reduction found that less than 50% of studies using information provision measured self-reported or observable meat consumption as an outcome variable (Harguess et al., 2020). Thus, there is a need to conduct further research to investigate the effects of information provision on encouraging behaviour change in relation to meat

[4] This study was developed in collaboration with myself, and uses the same methodology as the second study presented in this thesis.

consumption, given that intentions to eat less meat do not necessarily lead to changes in diet (e.g. Allen & Baines, 2002; Stubbs, Scott & Duarte, 2018). Most studies have also measured intervention effects at a single time point, during or shortly after treatment (e.g. Carfora et al., 2017b; Cordts et al., 2014; Stea & Pickering, 2018). Thus, little is currently known about whether interventions aimed at meat reduction might have effects on meat consumption post-intervention. The second study presented in this thesis aims to fill these gaps and add to the emerging literature on strategies aimed at meat reduction, by comparing the effectiveness of environmental, health and combined information, on reducing participants' red and processed meat consumption as part of a randomised messaging intervention, with comparisons made across different time points.

2.4.4 Maximizing the persuasiveness of information

While there is some evidence that providing information on the different impacts of meat can reduce intentions to eat meat, previous literature has indicated that providing information is generally not effective at encouraging pro-environmental behaviour change, especially when the behaviour in question is difficult or inconvenient (e.g. Abrahamse, Steg, Vlek & Rothengatter, 2005). Furthermore, there is often a gap between people's intentions and behaviour (e.g. Hassan et al., 2016), including meat reduction (e.g. Allen & Baines, 2002; Stubbs et al., 2018). However, there are a number of linguistic techniques that can be used to increase the likelihood that information will lead to behaviour change, which should be considered when designing informational strategies aimed at meat reduction. For example, setting a time-oriented goal, known as *goal setting*, can be used to improve the persuasiveness of messages in promoting behaviour change, including interventions aimed at meat reduction (e.g. Amiot et al., 2018). *Self-monitoring* can also be used to identify any discrepancies between one's actual behaviour and the target behaviour, to increase the likelihood of achieving a goal (e.g. Harkin et al., 2016). Self-monitoring has also been found to be an effective strategy with regards to reducing meat consumption (e.g. Reese et al., 2018; Carfora et al., 2017a, 2017b, 2019a). Past research has also indicated that focussing on the benefits associated with eating less meat and using prefactual "if…then" styled messages to make salient the connection between a behaviour (e.g. eating less meat) and the behavioural outcomes (e.g. reducing greenhouse gas emissions, improving health) can be particularly effective in promoting meat reduction (e.g. Berlotti, Carfora & Catellini, 2019; Berlotti, Chirchiglia & Catellani, 2016; Carfora et al., 2019a). Furthermore, previous research has indicated that the effectiveness of messages on eliciting healthy behaviour increases with the frequency of messages sent (Orr & King, 2015). Thus, different techniques can be used to maximize the effectiveness of informational strategies on eliciting behaviour change, with applications to encouraging meat reduction.

It is also important to consider the different ways in which information can be delivered. Recent years have seen an increased use of mobile phone apps to deliver health behaviour change interventions, given that interventions can be delivered on a large scale for little to no cost in this way (Direito, et al., 2014; Schumer, Amadi & Joshi, 2018). There has also been an increase in the use of mobile phone apps to promote pro-environmental behaviours, albeit it to a lesser extent, and apps can be used to promote health and pro-environmental behaviours simultaneously (Sullivan et al., 2016). In line with this, recent interventions on meat reduction have delivered randomised messaging interventions via text-messaging (e.g. Carfora et al., 2017b; Orr & King, 2015), and through messaging apps (e.g. Carfora et al., 2019a, 2019b). A benefit of using mobile phone apps is that information can be sent directly to participants, without them having to come to the laboratory. Furthermore, messages can be delivered to participants at specific times. For example, delivering messages on the consequences of meat consumption might be more effective if they are received shortly before mealtimes. This could therefore possibly maximise the effectiveness of interventions on encouraging behaviour change and in a more realistic setting.

It is important to note that even when care is taken to increase the effectiveness of informational strategies towards reducing meat consumption, information is not necessarily the most effective strategy for encouraging behaviour change (e.g. Abrahamse et al., 2005). However, as mentioned in section 2.4.2, information provision can provide a useful first step in raising awareness of the negative impacts of meat in a relatively easy and cost-effective way, whilst paving the way for other strategies towards meat reduction (Bicket & Vanner, 2016; Dagevos & Voordouw, 2013; Wellesley et al., 2015). Furthermore, future strategies could combine information with other strategies towards meat reduction, given that a combination of different strategies tends to be more effective in changing dietary behaviour, compared to when different strategies are implemented independently (e.g. de Bakker and Dagevos, 2012; Nederkoorn, Havermans, Giesen & Jansen, 2011). Thus, information provision could be considered alongside other strategies towards meat reduction, to increase their effect on encouraging behaviour change.

2.4.5 Potential replacements for meat

The studies reviewed in this section have investigated the effects of informational strategies on changing intentions to eat less meat or on meat consumption. However, these studies have not investigated what foods might be used by participants to replace meat in their diet following a successful intervention aimed at meat reduction. There are a number of options available with regards to meat-replacement. For example, individuals who reduce their meat intake might choose to increase their fruit and vegetable intake (e.g. Allen & Baines, 2002). Another option could be an increased uptake of plant-based meat-substitutes, defined as products developed from plant-proteins, soy, fungi, pulses or cereal protein (Hoek et al., 2011). Indeed, there is some evidence that individuals who consume low amounts of meat tend to eat more pant-based alternatives (Hoek et al., 2011). However, it should be noted that there is also evidence to suggest that meat-substitutes are not widely accepted, as a result of unfamiliarity with the products, perceived negative sensory appeal, and high cost (Elzerman, Hoek, Boekal,

& Luning, 2011; Hoek et al., 2011). Another, potentially more popular option, could be to replace red and processed meat with white meat or fish (e.g. Becerra-Tomas et al., 2016). However, despite evidence that replacing red and processed meat with white meat or fish can provide different health benefits (Becerra-Tomas et al., 2016), it is not clear whether these foods would be used by individuals as replacements for meat. In fact, few studies have investigated the types of foods that would be used to replace meat (e.g. Allen & Baines, 2002), while existing evidence tends to be correlational, drawing across different consumer segments (e.g. Hoek et al., 2011). It is important to consider what foods might be used by individuals to replace meat, to ensure that individuals are able to adopt a diet that is healthy and can realistically be maintained. Investigating which foods would be used to replace meat could also be useful for the development of campaigns aimed at meat reduction, as well as the marketing of meat-alternatives. As such, the use of white meat, fish and plant-based alternatives to replace red and processed meat is investigated as part of the second study presented in this thesis. These foods were chosen as the above literature has indicted them to be viable replacements for meat.

2.5 Behavioural spillover

2.5.1 Positive and negative spillover

There is a body of literature supporting that interventions can have effects beyond the targeted behaviour. For example, the 'halo effect' has been studied since the 1920s and describes how global evaluations can be extrapolated to unrelated attributes (Thorndike, 1920). Applied to interventions, studies have found that highlighting one attribute of a product, for example as being eco-friendly, can lead to generalised assumptions about other unrelated attributes, such as having an improved taste (Sörqvist et al., 2015). Secondary effects have also been found to influence behaviour. For example, 'response generalisation' has been studied since the 1970s and explains how an intervention targeting one behaviour, for example seat-belt use, can trigger another conceptually similar behaviour, such as increased signalling when driving (Ludwig & Geller, 1991; 1997). Against this background, the last decade has seen a growing interest in the potential of interventions to cause secondary effects, with a focus on pro-environmental behaviour. Specifically, there has been a growing interest for the potential of one pro-environmental behaviour to elicit additional pro-environmental behaviours through a process coined 'behavioural spillover'.

Positive behavioural spillover occurs when adopting a pro-environmental behaviour increases the likelihood that other subsequent pro-environmental behaviours will also be performed (Poortinga, Whitmarsh & Suffolk, 2013). Though it should be noted that other terms have been used to describe this effect. For example, Thøgersen and Crompton (2009) suggested that performing a relatively easy pro-environmental behaviour can act as a 'foot-in-the-door' to performing other potentially more challenging and higher impact pro-environmental behaviours, through a 'virtuous escalator'. The UK government's Department for Environment Food and Rural Affairs (DEFRA, 2008) similarly describe how pro-environmental behaviours can act as a 'wedge' or 'catalyst' for other pro-environmental behaviours.

One of the reasons for the increased attention afforded to the study of behavioural spillover is that, from a policy perspective, is has the potential to catalyse a range of pro-environmental behaviours in a cost-effective way and with little regulation (Galizzi & Whitmarsh, 2019). As such, research has focussed on the types of behaviours for which spillover might occur and the potential driving mechanisms of this phenomenon. Past literature has demonstrated that behavioural spillover is most likely to occur between similar behaviours (Whitmarsh & O'Neill, 2010), and can occur between both private-sphere (i.e. consumer or domestic) and public-sphere (i.e. political or social) behaviours (Nash et al., 2017; Stern, 2000). For example, Lanzini and Thøgersen (2014) found that an intervention aimed at encouraging green purchasing behaviour also led to an increase in recycling, public transport use as well as water and energy saving behaviours. Furthermore, Thomas, Sautkina, Poortinga, Wolstenholme and Whitmarsh (2019) found that a charge on plastic shopping bags led to an increased use of re-usable bags as well as an increased support for other waste-related policies. Goal-framing theory can be used to explain spillover, as a common motivation or overarching goal, for example to mitigate rising greenhouse gas emissions, is thought to cause an indirect link between different behaviours (Lindenberg & Steg, 2007). In line with this theory, Evans et al. (2012) found that participants were more likely to recycle a sheet of paper following a task highlighting the environmental aspects of a behaviour (car-sharing), whereas this was not the case when financial aspects were highlighted. Thus, an intervention aimed at one behaviour has the potential to catalyse other lifestyle changes which share an underlying goal, maximising the positive outcomes of an intervention on the environment.

However, negative spillover can also occur, whereby successfully encouraging an individual to adopt a pro-environmental behaviour can lead to a decreased willingness to perform other pro-environmental behaviours or an increase in environmentally unsustainable behaviours (Thøgersen & Crompton, 2009). For example, Tiefenback, Staake, Roth and Sachs (2013) found that households who reduced their water consumption following an intervention aimed at water conservation subsequently increased their energy consumption, compared to a control group. This can occur as a result of 'moral licencing', whereby a person feels that they have moral leeway after performing a pro-environmental behaviour (Gneezy, Brown & Norton, 2012; Mazar & Zhong, 2010). Negative spillover can also occur as a result of contribution ethic, whereby an individual feels as though they have already made a sufficient contribution towards the environment, which can act as a justification for not performing additional pro-environmental behaviours (Guagnano, Dietz & Stern, 1994; Thøgersen & Crompton, 2009). Furthermore, the single-action bias is used to describe when two actions perceived as fulfilling the same goal (e.g. reducing greenhouse gas emissions) are viewed as being interchangeable, leading to the perception that only one behaviour is needed to reach the goal and subsequently reducing the likelihood of the second behaviour being performed (Weber 1997, cited in Weber 2006). Thus, negative spillover has the potential to undermine efforts to promote environmentally friendly action.

Little is currently known about whether an intervention aimed at meat reduction would lead to positive spillover, negative spillover, or an absence of spillover all together. Considering that few studies have investigated the effects of interventions aimed at meat reduction on reducing meat consumption, even fewer studies have investigated whether a reduced consumption of meat might be associated with an increased uptake of other pro-environmental behaviours. Despite this, two recent studies have indicated some evidence of positive pro-environmental spillover following an intervention aimed at meat reduction. Carrico, Raimi, Truelove and Eby (2018) found that participants who reduced their red meat consumption for health or environmental reasons as part of a message framing intervention showed increased environmental concern, which in turn lead to an increased likelihood of donating to an environmental organization. Furthermore, a recent study found that individuals who reduced their red meat consumption during a workplace intervention were also more likely to engage in other pro-environmental behaviours outside of the workplace one month later, including buying local rather than imported food produce, recycling, eating smaller food portions, reducing packaging and buying products with sustainable palm oil (Verfuerth, Jones, Gregory-Smith & Oates, 2019). Thus, while the literature in this area is limited, there is some recent evidence that an intervention aimed at meat reduction could potentially lead to an increased uptake of other private- and public-sphere pro-environmental behaviours. Moreover, the literature suggests that this effect can occur even if meat reduction is motivated by health rather than environmental motives (Carrico et al., 2018).

2.5.2 Factors underlying spillover effects

Whether or not adopting a pro-environmental behaviour might lead to behavioural spillover, and whether spillover effects are positive or negative, can be explained by different mechanisms or factors in line with different theories in psychology (Dolan & Galizzi, 2015; Lanzini & Thøgersen, 2014). In particular, pro-environmental self-identity has been identified as having an important influence on pro-environmental behaviour and on behavioural spillover. People with a strong pro-environmental identity are more likely to perform pro-environmental behaviours (e.g. Kashima, Paladino & Margetts, 2014). Furthermore, pro-environmental identity has been found to predict pro-environmental behaviour over and above other variables including past behaviour, attitudes, perceived behavioural control and subjective norms (Whitmarsh & O'Neill 2010). This can be explained through cognitive dissonance theory, as people aim to maintain a consistent sense of self and wish to avoid psychological discomfort known as 'cognitive dissonance', which can occur when people perceive a discrepancy between their beliefs and actions (Festinger, 1957). Furthermore, self-perception theory explains how perceiving past behaviour as pro-environmental can trigger subsequent pro-environmental behaviours as people make inferences about their identity based on past behaviour, which can subsequently lead people to act in accordance with that self-perception (Bem, 1972). As such, reminding individuals of their past pro-environmental behaviour can lead to an increased pro-environmental identity and a greater engagement in subsequent pro-environmental behaviours (Cornelissen, Pandelaere, Warlop & Dewitte, 2008; Van der Werff et al., 2014).

It is not clear whether pro-environmental identity would have the same effect on behavioural spillover following an intervention aimed at meat reduction, given that individuals do not tend to view meat as being an environmentally-significant behaviour (e.g. Bailey et al., 2014; Macdiarmid et al., 2016). However, there is some evidence that a reduced meat consumption can lead to an increased pro-environmental identity when the environmental impacts of meat are made salient. For example, Verfuerth et al. (2019) found that participants showed a stronger pro-environmental identity and an increased uptake of different pro-environmental behaviours following a workplace intervention focussing specifically and exclusively on the environmental impacts of meat. Thus, pro-environmental identity can have a mediating effect on positive pro-environmental behavioural spillover, where adopting a pro-environmental behaviour can lead to an increased pro-environmental identity, in turn resulting in other additional pro-environmental behaviours.

Behavioural difficulty is another factor influencing behavioural spillover, which can impact upon the strength of the relationship between performing an initial behaviour and positive spillover effects. Given that people can infer their self-perception from their past behaviour, it follows that an individual might be more likely to consider themselves to be a pro-environmental person if they recently adopted a difficult (rather than easy) or costly (rather than costless) pro-environmental behaviour (Truelove, Carrico, Weber, Raimi & Vandenbergh, 2014). Thus, adopting a difficult initial pro-environmental behaviour should lead to more positive behavioural spillover compared to when an easy behaviour is adopted (Maki et al., 2019). However, while some authors have indicated that behavioural difficulty has this moderating effect on behavioural spillover, few studies have tested this assumption empirically. Often, evidence from pro-social (rather than pro-environmental) behaviour is cited to support this relationship. For example, Gneezy et al. (2012) found that participants who made a costly donation identified more as being pro-social and were more honest on an interdependent game compared to control participants; while those who made a costless donation did not view themselves as being more pro-social and were less honest, compared to controls. However, there is little evidence supporting the role of behavioural difficulty in influencing pro-environmental behavioural spillover. For example, in a recent meta-analysis of 25 empirical investigations of behavioural spillover, Maki et al. (2019) did not find any investigation of a difficult initial pro-environmental behaviour. Although the meta-analysis found one study which tested the effects of a moderately difficult behaviour, they found contradictory evidence where performing a moderately difficult pro-environmental behaviour led to less positive spillover compared to when an easier initial behaviour was performed. Moreover, Van der Werff et al. (2014) found that signalling past behaviour as being difficult had no main effect on environmental identity or on positive spillover, although there was some evidence for an increased pro-environmental identity and positive behavioural spillover when past behaviour was signalled as being difficult and unique, compared to when this action was difficult but not unique, or when the action was unique but not difficult.

Thus, while behavioural difficulty is thought to have a moderating effect on positive pro-environmental spillover, there is currently little evidence in support of this effect.

Behavioural difficulty is particularly relevant for the study of meat reduction given that meat reduction is generally considered to be a difficult behaviour to perform. For example, Carrico et al. (2018) found that participants who were asked to reduce their meat consumption for health or environmental reasons showed an increased behavioural difficulty score compared to those in the control condition, supporting that reducing one's meat consumption was perceived to be a difficult behaviour. However, the effect of behavioural difficulty on subsequent spillover was not investigated in the study by Carrico et al. (2018). Thus, whether behavioural difficulty might moderate the relationship between meat reduction and subsequent spillover is currently unknown.

Another important factor thought to have a moderating effect on behavioural spillover is contribution ethic. Contribution ethic can be defined as the belief that one has already made a sufficient contribution to protect the environment, which can subsequently lead to reduced intentions to perform further pro-environmental behaviours (Thøgersen & Crompton, 2009). Indeed, Thøgersen and Crompton (2009) argue that individuals decline opportunities to engage in pro-environmental behaviours through the justification that they believe they have already 'done their bit' for the environment and can therefore 'rest on their laurels'. Thus, it follows that reducing one's meat consumption could lead to reduced intentions to perform further pro-environmental behaviours if these individuals have such contribution ethic beliefs. However, although contribution ethic is used to explain instances of negative behavioural spillover (e.g. Truelove et al., 2014), few studies have investigated this relationship empirically (Lauren, Smith, Louis & Dean, 2019). Lauren et al. (2019) aimed to overcome this limitation by testing the effect of different mechanisms of pro-environmental behavioural spillover. However, they found that reminding participants of their past pro-environmental behaviours lead to an increased contribution ethic, which subsequently led to *increased* intentions to perform other pro-environmental behaviours. In other words, contribution ethic was associated with positive rather than negative behavioural spillover.

Similar to contribution ethic, compensatory beliefs refer to the perception that the positive impacts of one pro-environmental behaviour cancel out the negative environmental impacts of an environmentally damaging behaviour (e.g. Hope, Jones, Webb, Watson & Kaklamanou, 2018; Kaklamanou, Jones, Webb, and Walker, 2015). For example, Kaklamanou et al. (2015) found that compensatory beliefs were negatively associated with ecological worldview, pro-environmental identity and self-reported pro-environmental behaviours. Compensatory beliefs have also been associated with increased environmentally damaging behaviour, or 'rebound effects' (e.g. Seebauer, 2018). However, there is limited research investigating the effect of compensatory beliefs on pro-environmental behaviour (Hope et al., 2018) and some studies have found low agreement scores with compensatory beliefs (e.g. Bratt, 1999; Kaklamanou et al., 2015) indicating that such beliefs might be uncommon (Capstick, Whitmarsh, Nash, Haggar & Lord, 2019). In a study that found high agreement scores for different compensatory beliefs, compensatory beliefs were, in some cases, found to positively predict pro-environmental behaviours (Capstick et al., 2019). Thus, while contribution ethic and compensatory beliefs are theorised to lead to negative pro-environmental behavioural spillover, currently there is little empirical evidence to support this.

In light of the literature reviewed above, the second study presented in this thesis aims to investigate whether encouraging individuals to reduce their red and processed meat consumption might lead to an increased willingness to perform additional pro-environmental behaviours via positive spillover. The effect of environmental identity, behavioural difficulty and contribution ethic are also examined, to add to existing literature and provide a greater understanding of the processes underpinning pro-environmental behavioural spillover following reduced meat consumption.

2.6 Aims of this thesis

So far, the introduction (Chapter 1) and literature review (Chapter 2) have highlighted that meat consumption is a major driver of climate change. This has led to an increase in studies investigating the motivations of individuals who have already eliminated meat from their diet, in addition to studies investigating strategies to reduce meat consumption among individuals who consume meat (see Harguess et al., 2020). However, fewer studies have investigated motivations for reduced meat consumption among meat-eaters, while interventions have tended to focus on encouraging intentions to reduce meat, rather than investigating changes in meat-eating behaviour. Moreover, few studies have investigated whether reduced meat consumption might spillover to other untargeted pro-environmental behaviours. This thesis aims to build on the existing literature to fill these research gaps, through addressing three main aims. First, this thesis aims to investigate the motives driving meat consumption and meat reduction, as well as awareness of the negative environmental impacts of meat, among individuals who include and exclude meat from their diet. Second, this thesis aims to test the effectiveness of providing information on the environmental, health or combined environmental and health impacts of meat, on reducing red and processed meat consumption, whilst also investigating what foods might be used as replacements for red and processed meat. Third, this thesis aims to investigate whether reduced red and processed meat consumption might lead to an increased willingness to perform untargeted pro-environmental behaviours through behavioural spillover, and what underlying factors might cause such an effect.

A mixed-methods approach is used to address these aims through an initial qualitative study involving semi-structured interviews with meat-eating and meat-free participants (study 1), followed by a quantitative study consisting of a randomised messaging intervention, food diaries, and series of surveys completed across three time points (study 2). It should be noted that while the first study explores meat consumption/reduction in general, the second study focuses specifically on reducing red and processed meat. This is because red meat is associated with greater negative environmental impacts, while red and particularly processed meat are associated with significant negative health impacts, compared to white meat (see chapter 1, sections 1.3 and 1.6). This has led some authors to conclude that strategies should focus on reducing red and processed meat specifically (see chapter 1, section 1.5). This thesis aims to add to existing literature to provide further insight, with an exploratory and hypothesis generating, rather than confirmatory, approach. A more detailed overview of each of the three research aims is provided below.

2.6.1 Motives driving meat consumption, meat reduction and awareness of the environmental impacts of meat

The first aim of this thesis is to explore the motives driving meat consumption, awareness of the negative environmental impacts of meat, and the motives driving meat reduction. This is addressed in two ways. First, qualitative interviews are used to ask meat-eating participants about their reasons for eating meat, their awareness about the negative environmental impacts of meat and their willingness to reduce their meat consumption for different reasons. Qualitative interviews are also used to investigate awareness of the negative environmental impacts of meat and reasons for adopting a meat-free diet among participants who exclude meat from their diet (e.g. as part of a vegetarian or vegan diet).

Second, baseline survey data from study 2, which contains constructs from the TPB and TTM, is used to investigate psychosocial factors associated with (meat-eating) participants' willingness to reduce their red and processed meat consumption. The TTM is used to investigate participants' readiness to reduce their red and processed meat intake, as indicated by the stages of change. Decisional balance and self-efficacy are also examined across the different stages. The TPB is then used to investigate intentions to reduce red and processed meat consumption. The role of identity in explaining additional variance in participants' intentions is also explored. The TTM and TPB are then combined to investigate differences in the TPB variables across each stage of change, to determine how an increased readiness to reduce one's red and processed meat consumption might be associated with differences in different psychosocial variables.

2.6.2 The effectiveness of environmental and health messages on reducing red and processed meat consumption and foods used as meat replacements

The second aim of this thesis is to investigate the effect of providing information on the environmental, health, or the combined environmental and health impacts of red and processed meat, on reducing participants' red and processed meat consumption. Participants' red and processed meat consumption is compared across three time points, to establish whether effects of information provision on consumption would persist after the intervention had ended. Following from this, this thesis aimed to investigate the types of food that might be used to replace red and processed meat during the intervention. This is tested as part of a randomised two-week messaging intervention as part of study 2.

2.6.3 Behavioural spillover as a result of red and processed meat reduction

The third aim of this thesis is to investigate whether a reduced consumption of red and processed meat might lead to an increased willingness to perform further untargeted pro-environmental behaviours through behavioural spillover, and what underlying factors might cause such an effect (see section 2.5). Specifically, this thesis uses survey data from study 2 to test whether spillover might be attributed to an increased pro-environmental identity, and whether behavioural difficulty might increase, and contribution ethic might decrease, the likelihood of behavioural spillover occurring following a reduced consumption of red and processed meat.

Chapter 3: Methodological Considerations

3.1 Introduction

There are continuing debates surrounding the different research strategies used to study the social world. The most commonly drawn and notable distinction relates to the relative merits of qualitative and quantitative research. Although qualitative and quantitative approaches involve different methods, the key issues associated with the debate relate to the ontological and epistemological position associated with each research tradition. Ontology concerns the way in which social reality is viewed, while epistemology entails what is considered to be acceptable and warrantable knowledge (Bryman, 2016). In brief, quantitative research is associated with the positivist assumption that social phenomena represent an objective reality that is beyond the reach of the observer, while qualitative research is associated with the constructivist position that there is no single 'objective' reality, as social phenomena are viewed as being constructed through people's experiences (Berger and Luckmann, 1966; Bryman, 2016; Guba & Lincoln, 1994). These differences have led some researchers to claim that qualitative and quantitative methods cannot and should not be combined. However, this view is generally out-dated and in recent years the integration of qualitative and quantitative methods via mixed-methods approaches has become increasingly popular. Mixed-method approaches are viewed as providing a comprehensive research framework that overcomes some of the limitations facing each individual method (Johnson & Onwuegbuzie, 2004; Johnson & Turner, 2003).

This thesis uses a mixed-methods approach through the integration of qualitative and quantitative research methods. The first study employs qualitative semi-structured interviews, while the second uses a quantitative experimental design. Therefore, it is appropriate that this chapter outline the foundations of qualitative and quantitative research, as well as the rationale for adopting a mixed-methods approach in this thesis.

The following sections discuss quantitative (section 3.2) and qualitative (section 3.3) research practices in relation to the ontological and epistemological position associated with each approach. The relative advantages and limitations of each method is also discussed. Section 3.4 outlines debates surrounding the use of mixed-methods research. Section 3.5 justifies the rationale for utilizing a mixed-methods approach in this thesis. Finally, section 3.6 outlines the methods, materials and procedures used within each study presented in this thesis.

3.2 Quantitative research

Quantitative research is often associated with the positivist doctrine, an epistemological position that supports the application of the methods used in the natural sciences to the study of the social world (Bryman, 2016). This is based on an objective ontological position asserting that the social world is not fundamentally different from the natural world and can subsequently be observed in the same way. Objectivism posits that social phenomena exist as facts beyond the influence of the researcher and are therefore observable within a value-free framework (Denzin & Lincoln, 1994; Guba & Lincoln, 1994). Thus, a deductive approach is generally employed, where existing theory is used to generate hypotheses, which are subjected to rigorous empirical testing.

In line with this, quantitative research involves the quantification of social phenomena using standardized measures so that concepts can be observed and tested using the scientific method, with an emphasis on attempting to explain human behaviour through the different factors that are perceived to influence it (Bryman, 2016). An emphasis is placed on an objective form of enquiry, thus quantitative researchers try to remain emotionally uninvolved with their subjects so as not to bias results (Johnson & Onwuegbuzie, 2004). Quantitative research also focuses on producing findings that can be generalized beyond the time and context in which research is conducted. Therefore, quantitative studies tend to include a large number of participants, to produce a sample that is viewed as being representative of the population (Carey, 1993). Studies are also often replicated, to ensure the reliability of findings. These procedures are put into place so that quantitative research findings can be interpreted as representing an accurate depiction of the social world.

Despite the ability to produce precise and reliable data, quantitative research has received a great deal of criticism over the years, particularly from advocates of qualitative research. These critiques mostly relate to the positivist assumption that the scientific method can be appropriately applied to investigate social phenomena. Quantitative research is criticized for ignoring the role of *meaning,* which is thought to play a central role in the interpretation and construction of the social world (Schutz, 1962). Similarly, it is argued that the measures developed for social inquiry as part of the quantitative approach are too far removed from the concepts they are designed to capture, while the reliance on quantitative instruments is thought to hinder the connection between research and everyday life (e.g. Allport, 1962; Dilthey, 1894). Furthermore, the analysis of relationships between quantitative variables is thought to produce an oversimplified version of the social world (Bulmer, 1985 cited in Bryman, 2016). Consequently, quantitative research is criticized for producing findings that do not connect to everyday contexts but represent a static social world independent of people's experiences (Bryman, 2016).

3.3 Qualitative research

Qualitative research is associated with interpretivism, an epistemological position asserting that the subject matter of the social sciences is fundamentally different from that of the natural sciences and subsequently cannot be studied in the same way (Gray, 2013). This is founded on a constructivist ontological position, which views the social world as being constructed by people's interactions and the meanings that are attributed to them (Berger & Luckmann, 1994). According to this view there are multiple changeable realties, which are continually accomplished and revised by social actors (Sale, Lohfeld & Brazil, 2002) and there is no single reality separate to the researcher (Smith, 1983). In fact, the researcher is viewed as being interactively linked with subjects of inquiry, so that research findings are created mutually, within the context of the research (Guba & Lincoln, 1994).

In line with this, qualitative research focuses on examining the way in which the social world is interpreted from the perspective of its participants, in an attempt to understand (rather than explain) social reality (Henwood & Pidgeon, 1992). An inductive strategy is generally employed, where theory is generated from the collection and analysis of data (Bryman, 2016). Qualitative research tends to involve non-numerical data gathered from small and purposeful samples, with the goal of providing rich accounts of people's experiences (Reid, 1996). An emphasis is also placed on providing a detailed account of the setting in which behaviour takes place, to provide a contextual understanding of social phenomena. These 'thick descriptions' also provide a database for making judgements about the transferability of research findings to other similar contexts (Geertz, 1973). Qualitative research is conducted in this way so that in-depth accounts of social phenomena can be produced, enabling an understanding of the social world from the perspective of its participants.

However, qualitative methods have also received much criticism over the years, particularly by exponents of quantitative research. The main critique of qualitative research is that it is too subjective. Qualitative research relies on a close relationship between the researcher and the studied participants, thus qualitative research is viewed as being prone to bias, as study findings can be more easily influenced by the expectations and personal beliefs of the researcher (Johnson & Onwuegbuzie, 2004). Qualitative data analysis is also thought to be subjective, as study findings are determined by the researcher's interpretations of the areas of data that are important or significant (Bryman, 2016). Furthermore, qualitative research has been criticized for lacking in transparency, as it is not always stated how or why certain individuals have been chosen to take part in a study, or what procedures have been carried out by the researcher, how qualitative data analysis has been conducted or what type of analysis was involved (Bryman & Burgess, 1994). However, a greater importance has been placed on the role of transparency and coherence in qualitative research in recent years in order to address these issues (Yardley, 2000). For example, Yardley (2000) advocates that researchers should be explicit about the methods and procedures used and should be reflexive about the implications of their personal values, biases and decisions on their construction of knowledge in relation to the social world. However, this is a relatively recent approach that is not always adopted in qualitative research.

3.4 Mixed-methods research

It is clear that qualitative and quantitative research approaches are associated with a number of different strengths and weaknesses, as noted in the previous sections (3.2 and 3.3). On the other hand, combining qualitative and quantitative research strategies through a 'mixed-methods' design can capitalise on the respective strengths and can to some extent overcome the respective weaknesses of each individual method (Johnson & Turner, 2003; Tashakkori, & Teddlie, 2003). However, there is some controversy regarding the feasibility and desirability of mixed-method approaches. The main argument against the use of mixed-methods is that qualitative and quantitative methods are separate paradigms, each linked to different epistemological and ontological commitments, values, and methods (Guba & Lincoln 1994; Guba, 1990; Smith & Heshusius, 1986). This argument is based on the premise that methods of data collection are committed to specific views regarding the kind of knowledge that is considered to be warrantable, and the means of generating knowledge that are considered to be appropriate. Thus, a decision to employ a questionnaire or attitude scale would represent not only a method of data collection but also a commitment to an epistemological position, for example one that is consistent with the positivist tradition. Consequently, qualitative and quantitative methods are viewed as being incommensurable with the other and the apparent integration of qualitative and quantitative research methods within mixed-methods designs is viewed as being done only in a superficial way and within one single paradigm (Smith & Heshuius, 1986). For example, Smith and Heshuius (1986, p.8) argue that integrating qualitative and quantitative research methods turns "qualitative inquiry into a procedural variation of quantitative inquiry".

However, the assumption that research methods and epistemology are synonymous can be viewed as being out-dated, as many authors now accept that epistemology does not necessarily dictate which methods of data collection and analysis should be used within qualitative or quantitative approaches (Johnson & Onwuegbuzie, 2004). Furthermore, although qualitative and quantitative research strategies are associated with particular methodologies, the objectives and nature of inquiry are consistent within each paradigm (Dzurec & Abraham, 1993, cited in Johnson & Onwuegbuzie, 2004). For example, both research strategies employ empirical observation to address research questions, describe and construct arguments to explain data, and attempt to explain research outcomes (Sechrest & Sidani, 1995). Thus, differences in epistemological position should not prevent a qualitative researcher from utilizing methods that are more typically associated with quantitative research and vice versa (Johnson & Onwuegbuzie, 2004).

3.5 Approach of this thesis

The epistemological position of this thesis is aligned with the 'pragmatist' position (e.g. Feilzer, 2010; Howe, 1988; Johnson & Onwuegbuzie, 2004). This approach sidesteps ontological debates surrounding truth and reality, contending that knowledge can be both constructed *and* based on the reality of the world in which we live (Feilzer, 2010; Johnson & Onwuegbuzie, 2004). An emphasis is placed on the empirical and practical consequences of different methods, so that the most appropriate way of investigating the social world can be employed (Johnson & Onwuegbuzie, 2004; Tashakkori & Teddlie, 2003). Specifically, pragmatism acknowledges the strengths and weaknesses of qualitative and quantitative research methods and considers different approaches to be appropriate for different research purposes (Keele, 2006). Thus, mixed-methods are viewed as being able to fulfil different yet complementary purposes, whilst overcoming the overlapping weaknesses of qualitative and quantitative research designs (Johnson & Turner, 2003).

In line with this position, this thesis employs a mixed-methods approach, with a sequential qualitative-quantitative design (Morse, 1991). First, qualitative semi-structured interviews are used to explore in-depth the motives driving meat consumption and meat reduction, as well as participants' awareness of the negative environmental impacts of meat. The findings from this study are in part used to develop the second, quantitative study presented in this thesis, consisting of a randomised messaging intervention, food diaries, and a series of surveys completed across three time points. This second study is used to investigate the psychosocial factors associated with participants' willingness to reduce their red and processed meat consumption, adding to the findings of the initial qualitative study. The second study uses quantitative methods to test the effectiveness of providing information on the environmental, health or combined environmental and health impacts of meat on reducing participants' red and processed meat consumption, whilst also investigating what foods might be used to replace red and processed meat. This study also investigates whether reduced red and processed meat consumption might lead to changes in untargeted pro-environmental behaviours through behavioural spillover, and what underlying factors might cause such an effect (see chapter 2 section 2.6).

This design is chosen because meat reduction is still a relatively understudied area, although it is becoming an increasingly popular topic in the field of environmental psychology. Therefore, an initial qualitative study can help to explore this issue in-depth and can help to create theoretical concepts and hypotheses that are meaningful, while a quantitative study can test these ideas utilizing items that are valid and reliable (Keele, 2006). As the qualitative research is carried out primarily as a basis for further empirical testing, the quantitative component of this research is more substantive than the qualitative component. Thus, the approach used in this thesis can also be defined as 'quantitative-dominant mixed-methods research' (Johnson, Onwuegbuzie & Turner, 2007). It should be noted that the qualitative and quantitative studies were used to address different research aims (see chapter 2, section 2.6). Thus, the qualitative study was only partially used to inform the development of the quantitative intervention study. Where the findings from the qualitative study directly feed into the development of the intervention study is explicitly stated at the end of chapter 4 (section 4.4.3). The methods used in each study is outlined in detail in the following section.

3.6 Methods and Materials

3.6.1 Study 1: Qualitative semi-structured interviews

The initial qualitative study used semi-structured telephone interviews to investigate the motives driving meat consumption and meat reduction, as well as awareness of the environmental impacts of meat (see chapter 2, section 2.6). Semi-structured interviews were used so that participants would be able to openly express their feelings and experiences without being constrained to pre-determined response options, as with forced-choice questionnaires. This method would also provide scope for additional topics to be discussed, as and when they emerge throughout the interviews.

3.6.1.1 Participants and sampling

The study was advertised in different places and on various social media websites aimed towards specific groups of people, to try to capture participants with different diets and different dietary concerns. Participants with unrestricted diets were targeted by contacting members of the Cardiff University community panel, an online system whereby members of the public can apply to take part in paid research (n = 5). Participants with unrestricted diets were also targeted by advertising the study using posters in a local gym and through online social media pages associated with the gym (n = 2). It was thought that participants from the community panel and from the gym would be the most likely to include meat in their diet. Participants with meat-free diets were targeted through advertising on an online Facebook page for vegans in the local area (n = 6). Participants who had recently adopted a meat-free diet were targeted through advertising on online social media pages for 'Veganuary' (n = 5), an online campaign encouraging individuals to eat a vegan diet throughout the month of January (see uk.veganuary.com). Finally, participants with a concern for the environment were targeted via snowball sampling, by contacting a member of 'People and Planet', an environmental campaign within Cardiff University (n = 4). In all cases, the study was advertised using the following description; "*We are conducting research on attitudes towards food choice and diet. Participants will be required to discuss their own eating behaviour and food choices during a one-off* *telephone interview."* Participants were informed that the interview would take one hour and were offered an incentive of £10 for taking part. In total, 22 participants took part in the study. In total, 8 participants included meat in their diet, although one of these participants identified as being mostly pescatarian. 14 participants indicated that they did not include meat in their diet, these participants were both vegetarian (n = 2) and vegan (n = 12). Participants were female (n = 18) and male (n = 4) with a mean age of 30. A summary of the sampled participants can be viewed in Table 1.

Table 1. Summary of participant demographics and diets for study 1

Alias	**Sample**	**Location**	**Ethnicity**	**Gender**	**Age**	**Diet**
Becky	Community Panel	Wales	Caucasian	Female	24	Omnivore
Beth	Community Panel	Wales	Caucasian	Female	20	Omnivore
Hannah	Community Panel	Wales	Caucasian	Female	23	Omnivore
Amy	Community Panel	Wales	Caucasian	Female	21	Omnivore
Katie	Community Panel	Wales	Caucasian	Female	35	Omnivore
Anna	Cardiff Vegans	Wales	Caucasian	Female	24	Vegan
Jonathan	Cardiff Vegans	Wales	Caucasian	Male	54	Vegan
Mark	Cardiff Vegans	Wales	Caucasian	Male	37	Vegan
Chris	Cardiff Vegans	Wales	Caucasian	Male	22	Vegetarian
Angela	Cardiff Vegans	Wales	Caucasian	Female	21	Vegetarian
Lucy	Cardiff Vegans	Wales	x	Female	19	Vegan
Catherine	People & Planet	Wales	Caucasian	Female	21	Vegan
Thomas	People & Planet	Wales	Caucasian	Male	20	Vegan
Emma	People & Planet	Wales	Caucasian	Female	19	Vegan
Georgia	People & Planet	Wales	Caucasian	Female	x	Omnivore
Olivia	Gym	Wales	Caucasian	Female	22	Omnivore/Pescatarian

Karen	Gym	Wales	Caucasian	Female	42	Omnivore
Charlotte	Veganuary	Scotland	Caucasian	Female	47	Vegan
Isabella	Veganuary	England	Caucasian	Female	33	Vegan
Amelia	Veganuary	England	x	Female	44	Vegan
Zoe	Veganuary	England	Caucasian	Female	48	Vegan
Kim	Veganuary	x	Caucasian	Female	39	Vegan

Note. Missing values are denoted by ‘x’.

3.6.1.2 Interview content

An interview guide was used to structure interview questions. The interview was structured around six main question segments relating to: (1) demographics, (2) food choice motives, (3) dietary identity and restrictions (including motives for avoiding meat and other animal products if relevant), (4) awareness of the environmental impacts of eating meat, (5) motives driving meat consumption and willingness to reduce meat (meat-eaters only) and (6) experience of Veganuary (Veganuary participants only). The full interview guide can be viewed in Appendix A.

1. *Demographics*

Participants were asked a short set of demographic questions relating to their country of residence, gender, age, ethnicity, and employment status.

2. *Food choice motives*

This section aimed to gauge the type of diet that participants had, in addition to the factors underlying their dietary choices. Participants were eased into the interview process and were asked about the different foods they ate and their reasons for eating those foods in particular. Participants were then asked whether concern for the environment, animal welfare and country of origin, as well as health, taste and price, influenced their food choice. These questions were based on previous literature, which has indicated these factors to be key determinants of food choice (e.g. Lindeman & Väänänen, 2000; Steptoe, Pollard & Wardle, 1995).

3. *Dietary identity and restrictions*

The aim of this section was to identify whether participants restricted anything from their diet and their motives for doing so. This section also aimed to examine the ways in which participants with different diets used different dietary labels, and how important their diet was to their identity. Participants were asked whether they excluded anything from their diet and if so, why. Participants were then asked what label they thought best described their diet from a choice of: omnivore, pescatarian, vegetarian, vegan, or another label not mentioned. Participants were asked why they chose their selected dietary label and how important that label/ their diet was to their identity. Participants were asked for how long they had eaten their current diet and if applicable, how long they had excluded certain food groups, i.e. meat and/or other animal products, from their diet for. Participants were asked about how easy or difficult it is for them it to maintain their diet. Those who had transitioned from one diet to another (e.g. from eating meat to being vegan) were asked an additional series of questions regarding this change, including the ease of their transition.

4. Awareness of the environmental impacts of meat

This section aimed to explore participants' awareness of the environmental effects of their diet, specifically the environmental impact of eating meat, as well as participants' willingness to change their diet to have a lesser negative impact. Participants were asked whether they thought their diet had any impact on the environment and whether they thought their diet could be more environmentally friendly. Participants were asked whether they would be willing to alter their diet to have a lesser negative impact on the environment and how easy or difficult they perceived those changes to be. This was to identify any potential barriers preventing participants from making more sustainable and environmentally friendly food-choices. Participants were then asked about their environmental concern and whether they engaged in any pro-environmental behaviours. Participants were asked who they thought was responsible for minimizing the negative environmental impact of food and what could be done to limit food-related environmental damage. Finally, participants were asked whether there was anything that they thought might change their diet in the future.

5. Motives driving meat consumption and willingness to reduce meat

This section aimed to identify the factors governing meat consumption and participants' willingness to reduce their meat intake. Participants were asked how frequently they ate meat and why they chose to include meat as part of their diet. Participants were also asked how important it was to them to eat meals that contained meat. Participants were then asked whether they also included meat-free meals in their diet and if relevant, their motives for doing so. Finally, participants were asked whether they would be willing to reduce their meat intake or exclude meat from their diet entirely for a variety of different reasons relating to health, the environment, animal welfare and the welfare of workers. They were also asked whether they were aware of the impact of livestock production on each of these factors.

6. *Experience of Veganuary*

This section aimed to identify the factors that motivated participants to take part in 'Veganuary', a campaign where people attempt to adopt a vegan diet for one month, during January (see uk.veganuary.com). Participants were asked to describe their experience of taking part in Veganuary, including where they had heard about the campaign and what had encouraged them to take part. Participants were asked whether they had eaten meat-free meals prior to taking part in Veganuary and whether they had chosen to continue eating a meat-free diet after the campaign had finished. Participants were asked whether there was anything that made participating in Veganuary particularly easy or difficult to do. Finally, participants were asked whether they felt that taking part in Veganuary had impacted any other areas of their life, including their perception of themselves and their awareness of issues relating to health, the environment and animal welfare.

3.6.1.3 Procedure

A total of 22 semi-structured telephone-interviews were conducted between the 15th March and 12th April 2017. Interviews were conducted over the telephone for convenience. It was thought that this would not affect the quality of the interviews given similarities in the findings and quality of data yielded from telephone and face-to-face interviews (Sturges & Hanrahan, 2004)[5]. The interviews

[5] It was also thought that answering questions over the phone might encourage participants be more honest, as telephone interviews are thought to be less anxiety provoking than face-to-face interviews (Bryman, 2016).

were scheduled for one hour and the duration of each interview ranged from 20 minutes to two hours. Participants were emailed an information sheet to read before the interview, which was repeated verbally at the start of the interview. Following verbal consent to participate, participants were asked a series of questions, as dictated by the interview guide. Questions were predominantly open-ended, and participants were asked follow-up questions (e.g. “can you elaborate on that?”) when appropriate. At the end of the interview participants were thanked for their participation and emailed a debrief form.

3.6.1.4 Reflexivity

As noted earlier in this chapter (see section 3.3), a recent emphasis has been placed on transparency and coherence in qualitative research with regards to the processes involved during data analysis and the potential influence of the researcher’s own values and beliefs on the research findings (Yardley, 2000). In light of this, a reflexive approach was used throughout the interview process, by using a reflexive diary to record my own experiences during data collection. Care was taken consider the influence of my own experiences and views on the interpretation of the data. Attention was also paid to the grounded nature of the data by focussing on the content of interview transcripts and by supporting themes with participant quotes, to minimize potential sources of bias. The potential influences of my own experiences on the interpretation of the data are discussed at the end of this thesis, in chapter 8 (section 8.5).

3.6.1.5 Interview data analysis

Interviews were recorded and transcribed by the researcher (myself), allowing for familiarization with the data corpus (Riessman, 1993). Initial analytic ideas and patterns in the data were noted down during the interview process and during transcription. All of the data was then analysed using Nvivo for mac (version 12). Thematic analysis was used to identify themes in the data, following the processes outlined by Braun and Clarke (2006). The analytic process was predominantly theory driven, meaning the transcripts were searched with specific research aims in mind; to identify the motives driving meat consumption and meat reduction, and to identify participants' awareness of the negative environmental impact of meat. These aims were used with the topics from the interview guide to guide initial coding. Initial codes were generated using a deductive approach, where codes were applied to portions of text associated with the research aims as well as themes identified as governing food choice in previous literature. Transcripts were then coded using an inductive approach where codes were created, updated and refined as meaningful topics emerged from the data. Codes presenting similar ideas or sharing similar properties were then collated to create themes, representing broader patterns of meaning in the data set. These themes were then reviewed in relation to their application to the coded extracts of text as well as the entire data corpus. A recursive process was used where codes and themes were added, revised, and removed throughout the analytic process. The final themes and codes derived from the data can be viewed in Appendix B.

3.6.2 Study 2: Quantitative Messaging Intervention

The second study presented in this thesis used a quantitative experimental design to investigate psychosocial factors associated with participants' willingness to reduce their red and processed meat consumption as indicated by the TPB and TTM, to test the effectiveness of environmental, health and combined messages on reducing red and processed meat consumption whilst also investigating what foods might be used to replace red and processed meat, and to investigate whether reduced red and processed meat consumption might lead to changes in untargeted pro-environmental behaviours through behavioural spillover (see chapter 2, section 2.6).

3.6.2.1 Participants

A student sample was used for convenience. Participants were recruited from different universities in Wales (Cardiff University, Cardiff Metropolitan University and Swansea University). The study was advertised on posters placed in university buildings, as well as through online social media pages and an online participant pool for Psychology undergraduate students, where Psychology undergraduate students can sign up to studies in exchange for payment or course credit. In all cases, the study was advertised as being "*a Psychology project about attitudes and food choice*". In the information sheet, the study was described as being about "*attitudes and red meat*" specifically. Participants were not informed that the study aimed to investigate an intervention for reducing red and processed meat consumption. Because the intervention was aimed at students who regularly consume red and processed meat, inclusion criteria were implemented so that only students who consumed on average three (or more) portions of red or processed meat each week qualified for participation. An inclusion criterion was also included whereby participants had to confirm that they were not following any specific diet plan in order to take part. Where the study was advertised, it was stated that only students who consumed at least three portions of red or processed meat each week would be eligible to take part. Participants were also required to confirm that they met each of the inclusion criteria via screening questions at the start of the survey. Those that did not meet all criteria were automatically directed to the end of the survey and were disqualified from participation.

A power analysis using G*power (for mac version 3.1.9.4) was conducted to determine the required sample size to detect changes in meat consumption between the different conditions over time. The analysis was based on a small-medium effect size ($\eta 2 = 0.30$), determined by similar past literature (Amiot et al., 2018; Carfora et al., 2017a). With a power of 0.95 and $\alpha = 0.05$, the results showed that a sample size of 250 participants was needed. This was used this as a guideline, with some oversampling in anticipation of participant drop-outs. In total, 320 participants took part at baseline in exchange for payment (£15) or course credits. At this time, the sample involved 293 undergraduate and 27 postgraduate students, with a mean age of 20 years. At this time, 260 participants were female and 59 were male, the gender information was missing for one participant. The majority of participants were from Cardiff University (n = 318), one participant was from Cardiff Metropolitan University and one participant was from Swansea University. At time 2 (end of the intervention), 251 (78%) participants answered the survey, of which 205 were female and 45 were male, the gender information was missing for one participant. At this time, 229 participants were undergraduate and 22 were postgraduate students, the mean age of participants was 20. The majority of participants were from Cardiff University (n = 250), one participant was from Swansea university (n = 1). At time 3 (one month after the intervention), 238 (74%) participants answered the survey, of which 191 were female and 46 were male, the gender information missing for one participant. At this time, 217 participants were undergraduates and 21 participants were postgraduate students, the mean age of participants was 20. The majority of participants were from Cardiff University (n = 237), one participant was from Swansea university (n = 1).

A between-subjects design randomly allocated participants to one of four conditions: (1) Health (T1: n = 78; T2: n = 58, T3: n = 56), in which participants received information on the impacts of red and processed meat on health. (2) Environment (T1: n = 83; T2: n =67; T3: n = 67), in which participants received information on the impacts of red and processed meat on the environment. (3) Combined (T1: n = 86; T2: n = 69; T3: n = 63), in which participants received information on the impacts of red and processed meat on both health and on the environment. (4) Control (T1: n = 73; T2: n = 57; T3: n = 52), in which participants did not receive any information on the impacts of meat. Participants in the health, environment and combined conditions were also provided with a time-oriented goal, to try to eat no more than two portions of red/processed meat each week for the two-weeks of the intervention. Participants in the control condition were asked not to change their diet in anyway. The information displayed to participants can be viewed in Appendix C.

3.6.2.2 Materials and Measures

The study included a pre-test, post-test, and follow-up survey, implemented online using Qualtrics. The study involved a randomised messaging intervention, which was implemented online through a pre-programmed automated Facebook chat using manychat.com. The study also included an online food diary, implemented on Qualtrics.

3.6.2.2.1 Survey Measures

The pre-test survey was given to participants at the start of the study (T1) and consisted of an information sheet and informed consent, the screening questions, questions relating to participant demographics, as well as measures of meat consumption. The survey included measures of participants' stage of change, decisional balance and self-efficacy, as constructs from the TTM (see chapter 2, section 2.3.1). The survey also included measures of participants' attitudes, intentions, perceived behavioural control, as well as subjective and descriptive norms, as constructs from the TPB (e.g. see chapter 2, section 2.3.2).[6] Measures of

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[6] Anticipated regret, attitudinal ambivalence and participants' desire to reduce their red/processed meat intake were also measured as constructs from the Theory of Planned Behaviour,

meat-eater, health and pro-environmental identity were included, to supplement investigations of the TPB (see chapter 2, section 2.3.3) as well as investigations of behavioural spillover (for the case of pro-environmental identity; see chapter 2, section 2.5.2). The post-test survey was administered to participants shortly after the two-week messaging intervention (T2) and the follow-up survey was sent to participants one month following from this (T3). Both the post-test and follow-up surveys included the same items as the pre-test survey, with the exception of the screening and demographic questions, and with an additional series of questions assessing behavioural spillover (see chapter 2, section 2.5). This included a measure assessing participants' willingness to perform additional pro-environmental behaviours not targeted by the intervention, in addition to a measure of contribution ethic and behavioural difficulty. Overall, reliability analysis revealed good internal consistency of the measures used in of the different surveys, across all time points (see Appendix D)[7]. Each of the measures used in the surveys are reported below in detail.

Demographics

Participants were asked a short set of demographic questions relating to their age, gender, level of study (e.g. undergraduate or postgraduate) and their year of study. Participants were also asked whether they were responsible for cooking their own meals (at least four times per week).

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to allow for comparison with data collected in Italy. However, these measures were not of interest to the aims of this thesis and therefore will not be discussed further.

[7] Most measures showed an internal consistency higher than $a = 0.60$, which is thought to be acceptable (Cronbach, 1951). The decisional balance perceived barriers measure had a Cronbach's alpha of $a = 0.54$ at time 1, which is slightly lower than generally accepted amount, however this measure was retained given that the measure was shown to be reliable at times 2 and 3 (a = 0.61 and $a = 0.66$ respectively). The descriptive norms measure showed a low internal consistency at times 1, 2 and 3 (a = 0.56, $a = 0.55$ and $a = 0.58$ respectively). However, this measure was retained since this variable was based on only two indicators and Cronbach's alpha is sensitive to the number of items, where fewer items are associated with a smaller alpha.

Meat consumption

Self-reported meat consumption was recorded using a measure adapted from existing literature (Carfora et al., 2017a, 2017b). Red, white and processed meat consumption was measured separately. For each type of meat, participants were provided with a definition (e.g. "*Processed meat includes meat that has been modified to improve its taste or shelf life through smoking, curing or adding salt or preservatives*…") and were given an example of a medium portion size in grams (e.g. "*A medium portion refers to about 60 grams, for example two small sausages or 5 slices of salami*…"). Meat consumption was recorded at T1, T2, and T3. At each time point, participants were asked to record the number of servings of red, white and processed meat they had consumed during the *previous week* (e.g. "*How many servings of processed meat have you eaten in the previous week? If you cannot remember please give your best estimate"),* using a 15-point response scale from 0 to 14 servings or more. Thus, the measures reflect the number of servings consumed by participants during one week before the intervention (T1), during the second week of the intervention period (T2) and four weeks after the intervention (T3).

Stage of change

Participants' readiness to reduce their red and processed meat intake was measured by a stage of change instrument adapted from Klöckner and Ofstad (2017). Participants were asked which of the following statements best described their views on their red and processed meat consumption from the following: (1) "I am satisfied with my weekly red/processed meat consumption and do not see any need to change it", (2) "I would like to reduce weekly my red/processed meat consumption but at the moment feel this is impossible for me", (3) "I would like to reduce my weekly red/processed meat consumption and plan to do this in the near future", (4) "I have reduced my weekly red/processed meat consumption already but feel this will be impossible to maintain", (5) "I have reduced my weekly red/processed meat consumption already and am satisfied with my current level of consumption" and (6) "I have reduced my weekly red/processed meat consumption already but plan to reduce my consumption even further". Statement 1 was coded as the precontemplation stage, statement 2 was coded as the contemplation stage, statement 3 was coded as the preparation stage and statements 4, 5 and 6 were coded as the action stage[8].

Decisional balance

Decisional balance was measured through eight items relating to the perceived benefits and barriers of reducing one's red and processed meat consumption. Items were based on the positive and negative factors associated with eating less meat, which were informed by the initial findings of the qualitative study presented in this thesis, as well as past literature (e.g. Lea et al., 2006). The perceived benefits were measured through the following four items: "I will be more content with myself if I reduce my weekly red/processed meat consumption", "I will feel healthier if I reduce my weekly red/processed meat consumption", "It will be better for the environment if I reduce my weekly red/processed meat consumption" and "I will save money if I reduce my weekly red/processed meat consumption". The perceived barriers were measured through the following four items: "reducing my red/processed meat consumption will not make any positive difference", "my diet will lack essential nutrients if I reduce my red/processed meat consumption", "reducing my red/processed meat consumption would be difficult" and "my diet will be less varied if I reduce my red/processed meat consumption". Participants rated how much they agreed with each statement on a 7-point Likert scale ranging from 1 = strongly disagree to 7 = strongly agree.

Self-Efficacy

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[8] Action was originally separated into (4) action dissatisfied, (5) action satisfied and (6) further action required, for exploratory purposes. However, it was decided to collapse these stages after the results revealed that only a very small portion of participants fell into each of these stages (T1: n = 7, n = 21, n = 20 respectively). The maintenance stage was not included as this study focussed on encouraging behaviour change among participants who regularly consumed meat.

Self-efficacy was measured through three items adapted from Lauren et al. (2017). These were "I feel capable of reducing my weekly red/processed meat consumption", "I am certain I can reduce my weekly red/processed meat consumption" and "It would be too difficult for me to reduce my weekly red/processed meat consumption" (reverse coded). Items were presented in the form of 7-point Likert scales ranging from 1= strongly disagree to 7 = strongly agree.

Attitudes

Attitudes were measured through eight pairs of adjectives in line with similar previous literature (Abrahamse et al., 2009; Wyker & Davidson, 2010). Participants were asked to indicate the extent to which they thought reducing their red/processed meat consumption would be: "bad-good", "inconvenient-convenient", "unnatural-natural", "immoral-moral", "expensive-affordable", "unappealing-appealing", "unhealthy-healthy" and "not environmentally-friendly - environmentally-friendly". Each pair was presented in the form of a 7-point Likert scale (e.g. 1 = bad, 7 = good).

Intention

Intention was measured through three items adapted from previous literature (Carfora, 2017a, 2017b). These were: "I intend to reduce my weekly red/processed meat consumption", "I plan to reduce my weekly red/processed meat consumption" and "I will reduce my weekly red/processed meat consumption". Items were presented as 7-point Likert scale ranging from 1 = strongly disagree to 7 = strongly agree.

Subjective norms

Subjective norms were measured through three items adapted from previous literature (Carfora, 2017a, 2017b). These were "Most people who are important to me think that I should reduce my weekly red/processed meat consumption", "Most people who are important to me would approve if I reduced my weekly red/processed meat consumption" and "Most people who are important to me would like me to reduce my weekly red/processed meat consumption". Items were presented as 7-point Likert scales ranging from 1 = strongly disagree to 7 = strongly agree.

Descriptive norms

Descriptive norms were measured through two items developed for the purpose of this study. These were: “Most people I know eat only a small amount of red/processed meat” and “it is very normal to eat only a small amount of red/processed meat”. Items were presented as 7-point Likert scales ranging from 1 = strongly disagree to 7= strongly agree”.

Perceived behavioural control

Perceived behavioural control was measured through two items based on past literature (Carfora et al., 2017a, 2017b). These were: “It is entirely up to me if I reduce my weekly red/processed meat consumption” and “There will be enough opportunities to reduce my weekly red/processed meat consumption”. Items were presented as 7-point Likert scales ranging from 1 = strongly disagree to 7= strongly agree”.

Identity

Participants’ health identity, pro-environmental identity and identity as a meat-eater, was measured using individual Likert scales as well as visual scale icons. Both scale and visual measures were used to capture different aspects of identity and considering that combining heterogenous items can increase scale validity (Eisinga, Grotenhuis & Pelzer, 2013). The visual scale measures for health, pro-environmental and meat-eater identity can be viewed in Appendix E.

Health identity was measured through three items adapted from Blake, Bell, Freedman, Solabianchi and Liese (2013). These were: “I am a healthy eater”, “I am someone who eats healthy foods” and “I am someone who avoids eating unhealthy foods”. Items were presented as 7-point Likert scales ranging from 1 = strongly disagree to 7 = strongly agree. Health identity was also measured through a visual scale similar to the Inclusion of Nature in Self scale (Schultz, 2001). Participants were given a brief description of '*a healthy person'* and were asked to select one of seven images, each depicting a pair of circles representing 1) the self and 2) an 'a healthy person', with varying degrees of overlap (see Appendix E). Responses were coded from 1 (no overlap between the circles) to 7 (complete overlap of the circles). Both scale and visual measures were combined to create an overall measure of health identity.

Identity as a meat-eater was measured through three items adapted from Blake et al. (2013). These were: "I am a meat eater", "I am someone who likes meat with every meal" and "I would feel at a loss if I had to give up eating meat". Items were presented as 7-point Likert scales ranging from 1 = strongly disagree to 7 = strongly agree. Identity as a meat-eater was also measured through a visual scale similar to the Inclusion of Nature in Self scale (Schultz, 2001). Participants were given a brief description of '*a meat-eater'* and were asked to select one of seven images, each depicting a pair of circles representing 1) the self and 2) 'a meat-eater', with varying degrees of overlap (see Appendix E). Responses were coded from 1 (no overlap between the circles) to 7 (complete overlap of the circles). Both scale and visual measures were combined to create an overall measure of meat-eater identity.

Pro-environmental identity was measured using a three-item scale adapted from Whitmarsh and O'Neill (2010): "I am an environmentally-friendly person", "I am someone who is concerned with environmental issues" and "I would be embarrassed to be seen as having an environmentally-friendly lifestyle" (reverse coded). The third item was removed after reliability analysis indicated doing so would significantly improve the reliability of this measure (from $a = 0.63$ to $a = 0.84$ at T1, from $a = 0.67$ to $a = 0.80$ at T2, and from $a = 0.63$ to $a = 0.80$ at T3). Items were presented as 7-point Likert scales ranging from 1 = strongly disagree to 7 = strongly agree. Pro-environmental identity was also measured through a visual scale adapted from the Inclusion of Nature in Self scale (Schultz, 2001). Participants were given a brief description of '*an environmentally conscious person'* and were asked to select one of seven images, each depicting a pair of circles representing 1) the self and 2) an 'environmentally conscious person', with varying degrees of overlap (see

Appendix E). Responses were coded from 1 (no overlap between the circles) to 7 (complete overlap of the circles). Both scale and visual measures were combined to create an overall measure of pro-environmental identity.

Behavioural spillover

Participants' willingness to perform other private- and public- sphere pro-environmental behaviours was measured through 10 items adapted from previous literature (Lauren et al., 2017; Whitmarsh & O'Neill, 2010). A range of different environmental behaviours were included to assess the effect of the intervention on more general environmental behaviours (e.g. having shorter showers) in addition to those more closely related to sustainable consumption behaviours (e.g. buying products with less packaging or eating less meat and dairy). Participants were asked how often they planned to perform the following behaviours in the next six months: "have shorter showers or infrequent baths", "purchase an eco-friendly product", "buy a product with less packaging", "buy organic food produce", "eat seasonal fruit and vegetables", "reduce my consumption of meat and dairy products", "use public transport instead of driving my car", "volunteer for an environmental group" and "donate to an environmental group". For each item, participants were asked to select one of the following options: "not at all", "once", "2 to 3 times", "4 to 5 times", "6 to 7 times", "8 to 9 times" or "more than 10 times". Responses were coded from 1 ("not at all") to 7 ("more than 10 times").

Contribution ethic

Contribution ethic was measured through three items adapted from Lauren et al. (2017). Participants were presented with the question, "How much do you do to protect the environment?" followed by three semantic differential scales with 7-point response options. These were as follows: 1 = not enough, 4 = enough, 7 = more than enough; 1 = less than my share, 4 = done my share, 7 = more than my share; and 1 = less than most, 4 = same as most, 7 = more than most.

Behavioural Difficulty

Behavioural difficulty was measured through three items adapted from Carrico et al. (2018). Participants were asked "how difficult is it for you to reduce your red/processed meat consumption?" on a scale from 1 = not at all to 7 = very much, "how much effort does it require?" on a scale from 1 = none at all to 7 = a great deal and "how much sacrifice does it require?" on a scale from 1 = none at all to 7 = a great deal.

3.6.2.2.2 Food diary

An online food diary was used to monitor participants' consumption of meat and potential meat replacements, during the two-week intervention period. The food diary was implemented via a survey on Qualtrics which was sent through a link in the Facebook chatbot during each day of the two-week intervention. Participants were asked to record in the diary which foods they had eaten throughout the day for breakfast, lunch and dinner, as well as any snacks. Participants could select which foods they had eaten from a list of response items (e.g., cereals, fish, red meat etc.) and had the option to enter free text for any foods not included within the provided response items. For each food, participants were required to indicate the number of portions consumed, as well as the portion size from "small," "medium," and "large." The food diaries were used during the two-week intervention period but were not used at baseline (T1) or after the intervention (T2 or T3).

3.6.2.2.3 Randomised messaging intervention

The randomised messaging intervention was run through an automated private chat on Facebook Messenger, which was built using 'ManyChat' chatbot software (Manychat.com). The intervention and messages were designed for the purpose of this study. Every day for two weeks, participants in the health, environment and combined conditions received messages on the positive impacts of eating less red and processed meat on health, the environment, or on both health and the environment (depending on condition). The messages used a prefactual "*if…then*" linguistic style, followed by a goal reminder to try not to eat more than two portions of red and processed meat each week (see chapter 2, section 2.4.3). This was followed by a reminder to complete the food diary. For example, in the environment condition, one message read: "*If you eat only a small amount of red and processed meat, you will protect the environment by reducing excessive land use. Remember to try and eat no more than two portions of red and processed meat this week. Please record all of the food you have eaten today using today's food diary*". The messages highlighted a different health and/or environmental issue each day of the intervention. Thus, participants in the health, environment and combined conditions received 14 different messages in total. The messages were sent to participants once in the morning (at 8am) and once in the evening (at 5pm), every day during the two-week intervention period. Control participants were not sent any information on the impacts of meat but were sent a reminder to complete the food diary every day of the intervention e.g. "*Please record all of the food you have eaten today using today's food diary*", once in the morning (8am) and again in the evening (5pm) every day during the intervention period. The different messages delivered to participants in each condition during each day of the two-week intervention period are summarised in Appendix F.

3.6.2.3 Procedure

The study was conducted entirely online using Qualtrics, Facebook Messenger and email. Participants who showed interest in taking part in the study were emailed a link to the pre-test survey. After providing informed consent and confirming that they met the inclusion criteria (via screening questions), participants were directed to answer a series of demographic questions and to report on their meat consumption for the preceding week. Participants then answered the remaining survey questions (e.g. constructs from the TTM and TPB). Following this, participants were randomly allocated to one of the four messaging conditions using a randomised display logic in Qualtrics. Participants were given a link to the automated chatbot on Facebook Messenger and were told that for the next study phase they would be required to complete a food diary every day for two-weeks. Control participants were asked not to change their diet during this time. Participants in the experimental (health, environment, combined) conditions were given some brief information highlighting the negative impacts of red and processed meat on either health and/or the environment (accordingly) and were asked to try to eat no more than two portions of red and processed meat each week during the two-week intervention. The pre-test survey ended after participants confirmed they had read and understood this information. The randomised messaging intervention began within one week of completing this survey. Participants were sent automated messages every day during the intervention via the automated Facebook chat. On the final day of the two-week intervention, participants were sent the post-test survey via the Facebook chat and through email. The one-month follow-up survey was sent to participants via the chatbot and email one month later. Participants were debriefed and then either awarded their credits or paid in cash, once data collection had ended.

3.6.2.4 Pre-analysis

3.6.2.4.1 Straightlining

The data was assessed for 'straightlining', whereby participants might provide the same consecutive response to multiple questions, suggesting a lack of attention to the questions. The variation within participants' responses was calculated and responses which showed a standard deviation of less than one were visually inspected for this reason[9]. Some responses showed low variation. Visual inspection showed that these participants had selected the midpoint (i.e. 'neither agree nor disagree') for multiple scale items. No participant data was excluded on the premise that these responses were not implausible, as participants may genuinely have felt neutral or ambivalent about reducing their meat consumption. Participant response times were also checked to assess for lack of attention. However, no clear pattern emerged between short response times, which were calculated as being lower than the median response time from the participant sample, and straightlining.

[9] The data of participants whose response time was equal to or less than half the expected response time (5 minutes instead of 10 minutes) was also visually inspected for straightlining.

3.6.2.4.2 Randomization checks

Participant demographics in each of the study conditions can be viewed in Appendix G. Descriptive statistics for the study variables across each of the study conditions can be viewed in Appendices H and J respectively. Pre-analysis was conducted to ensure adequate randomization of participants into the different conditions. Chi-square analysis was conducted to assess whether there were any differences between the demographics of participants in each condition. The results indicated that there was no significant association between age and condition (x^2 = 6.23, *p* = 0.392) gender and condition ($x^2 = 4.72$, *p* = 0.191), level of study and condition (x^2 = 1.97, *p* = 0.575) or year of study and condition ($x^2 = 6.77$, *p* = 0.343) indicating that randomization was successful.

Some participants indicated that they were not responsible for preparing their own meals at least four days each week (n = 12), which could potentially confound the effects of the intervention. Thus, chi-square analysis was computed to assess whether these participants were evenly dispersed across the different conditions. The results indicated there was no association between condition and whether participants prepared their own meals (x^2 = 3.03, *p* = 0.384), indicating that these participants were randomly distributed across conditions, minimizing any potential confounding effects.

Chi-square analysis was also conducted to assess whether there was any association between condition and stage of change at baseline. The results indicated that there was no significant association between condition and stage of change ($x^2 = 3.94$, *p* = 0.916), supporting that randomization was successful.

A one-way ANOVA was conducted to assess differences in TPB and identity variables across conditions at baseline. The results indicated that there was no significant difference for intention (*F* (3, 316) = 0.07, *p* = 0.978), attitudes (*F* (3, 316) = 0.39, *p* = 0.758) , subjective norms (*F* (3, 316) = 0.17, *p* = 0.915) descriptive norms

(*F* (3, 316) = 1.53, *p* = 0.207), perceived behavioural control (*F* (3, 316) = 2.06, *p* = 0.106), health identity (*F* (3, 316) = 1.35, *p* = 0.258), pro-environmental identity (*F* (3, 316) = 0.95, *p* = 0.419), or meat-eater identity (*F* (3, 316) = 0.63, *p* = 0.594), across the different conditions, again confirming that randomization was successful[10].

A one-way ANOVA was conducted to assess whether there were any differences in the amount of meat consumed by participants across the different conditions at baseline. The results indicated there was no difference between the amount of white (*F* (3, 316) = 2.46, *p* = 0.063), red (*F* (3, 316) = 0.72, *p* = 0.543) or processed meat (*F* (3, 316) = 0.19, *p* = 0.904) consumed by participants, further supporting that randomization was successful.[11]

3.6.2.4.3 Participant drop-outs

Analysis was conducted to assess whether participants who dropped out of the study either at post-test or at the one-month follow-up, were randomly distributed across each of the conditions. Chi-square analysis indicated no significant association between condition and whether participants dropped out of the study (x^2= 1.45, *p* = 0.698) indicating that the final participant sample was not skewed, minimizing any potential bias.

Analysis was also conducted to assess whether the final sample was representative of the initial sample for the different variables of interest. A one-way ANOVA was conducted to assess the different TPB and identity constructs for participants who dropped out of the study and those who did not. The results indicated that there were no significant differences in the attitudes (*F* (1, 318) = 1.76,

[10] Some variables (subjective norms and health identity) were found to violate the assumption of homogeneity. Non-parametric analyses using Kruskal-Wallace tests supported that there was no significant difference between conditions for the TPB constructs.

[11] Red meat consumption violated the assumption of homogeneity, however a non-parametric Kruskal-Wallace test supported that there was no difference between the amount of meat participants in each condition consumed.

p = 0.185), descriptive norms (F (1, 318) = 1.36, p = 0.244), perceived behavioural control (F (1, 318) = 0.28, p = 0.598), health identity (F (1, 318) = 0.00, p = 0.959), pro-environmental identity (F (1, 318) = 0.57, p = 0.451) or meat-eater identity (F (1, 318) = 0.55, p = 0.457), of participants who did and did not drop-out of the study. However, a significant difference for intention was found (F (1, 318) = 4.88, p = 0.028), where participants who dropped out of the study had higher intentions to eat less red and processed meat (M = 4.21, SD = 1.59) compared to those who did not drop-out of the study (M = 3.79, SD = 1.55). A significant difference was also found for subjective norms (F (1, 318) = 5.24, p = 0.023), where participants who dropped out of the study had higher subjective norms (M = 3.60, SD = 1.23) compared to those who did not drop-out (M = 3.28, SD = 1.16).

Chi-square analysis was also conducted to assess whether there was any difference in participants' stage of change for those who dropped out of the study and those who did not. The results indicated that there was no significant association between stage of change and whether participants dropped out of the study ($x^2 =$ 5.64, p = 0.130).

A one-way ANOVA was conducted to assess whether there were any differences in the amount of meat consumed by participants who did and did not drop out of the study. The results indicated that there was no difference between the amount of red (F (1, 318) = 0.25, p = 0.615), or processed meat (F (1, 318) = 0.12, p = 0.731), consumed by participants. However there was a significant difference between the amount of white meat consumed (F (1, 318) = 8.42, p = 0.004), where those who dropped out of the study ate significantly more white meat (M = 4.73, SD = 2.49) than those who did not drop-out from the study (M = 3.98, SD = 2.01).

3.6.2.4.4 Delayed completion of surveys

On average, participants completed the post-test 20 days after completing the initial survey and the follow-up test 31 days after completing the post-test. However, a number of participants answered the post-test and follow-up test beyond this period. Participants answered the post-test from 9-57 days after the initial survey and answered the follow-up test from 7-150 days after answering the post-test. Thus, analysis was conducted to assess whether the results of participants who answered the post-test 'late' (more than 40 days after completing the initial survey, n = 3) and who completed the follow-up test either 'early' (less than 15 days after completing the post-test n = 9) or 'late' (more than 50 days after completing the post-test n = 10) were evenly dispersed across the different conditions[12]. The results indicated that there was no significant association between condition and whether participants answered the post-test late ($x^2 = 1.58$, $p = 0.801$), or between condition and whether participants answered the follow-up test early ($x^2 = 5.04$, $p = 0.129$) or late ($x^2 = 0.75$ $p = 0.897$), suggesting that these participants were dispersed evenly across the different conditions and are therefore unlikely to significantly confound any results.

3.6.2.4.5 Assumption checks

Normality, skewness and kurtosis were visually inspected for each of the parametric tests conducted.[13] All items showed reasonable variation and were not skewed. In cases where the assumption of homogeneity was not met (when using ANOVA), results were also validated with non-parametric tests. Preliminary analyses were conducted for the regression analyses and confirmed that assumptions relating to linearity, independence of observations, multicollinearity, homoscedasticity and normality of residuals, were met[14].

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[12] It was thought that the effects of the intervention might begin to wear off for those who answered the post-test more than 40 days after the initial survey, that those who answered the follow-up survey less than 15 days after the post-test might still be under some influence of the intervention, and that the effects may have completely worn off for those who answered the follow-up survey later than 50 days.

[13] Histograms and normal Q-Q plots were used, given that statistical tests for normality are prone to false positives in large data sets (e.g. more than 30 participants per group; Field, 2009).

[14] Some regression models showed error variances which slightly deviated from a normal distribution. However, this was not thought to be problematic given the robustness of regression

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analyses to violations of normality, especially with large sample sizes (e.g. Li, Wong, Lamoureux & Wong, 2012; Lumley, Diehr, Emerson & Chen, 2002).

4.1 Introduction

This chapter addresses the first aim of this thesis, which was to investigate the motives driving meat consumption and meat reduction, as well as awareness of the negative environmental impacts of meat (see chapter 2 section 2.6). This is done by reporting on the findings from the initial qualitative study, in which semi-structured interviews were conducted with participants who regularly consume meat, referred to as meat-eating participants, as well as those who exclude meat from their diet, referred to as meat-free participants. A summary of the participant sample, including participant demographics and diets, can be viewed in chapter 3 (section 3.6.1).

The following section (4.2) discusses the findings from the interviews with meat-eating participants, to explore participants' motives for consuming meat, their awareness of the negative impacts of meat on the environment, and the motives that could encourage them to reduce their meat consumption. Section 4.3 discusses the findings from the interviews conducted with meat-free participants, to explore participants' motives for eliminating meat from their diet, as well as participants' awareness of the negative environmental impacts of meat and the relative impact that this might have had on their decision to adopt a meat-free diet. Section 4.4 provides a summary of the findings from both sets of interviews, in relation to the first research aim of this thesis. The novel contributions of this study are also discussed.

4.2 Motives driving meat consumption, meat reduction and awareness of the negative environmental impacts of meat, among meat-eating participants

4.2.1 Motives for meat consumption

To gauge the motives driving meat consumption, meat-eating participants were asked "*Why do you eat meat?*" and "*Is there anything about meat you find particularly appealing?*". The words most frequently used in response to these questions are shown in Figure 3[15].

Figure 3. Word cloud representing meat-eating participants' motives for meat consumption.

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[15] The word clouds presented in this thesis are for illustrative purposes only and do not represent a form of analysis in their own right.

Note. The frequency of words used in participant responses is depicted by size, where more frequently chosen words are depicted in a larger font than less frequently chosen words.

4.2.1.1 Taste & health

As shown by Figure 3, participants listed a number of different reasons for eating meat, including taste preferences, desire to vary one's meals and concern for health. Participants enjoyed eating meat and taste played a prominent role in motivating meat consumption, with almost all participants indicating that they ate meat because they enjoyed the way it tasted. Related to this, participants felt that meat added variety and made meals more substantial. Many also commented that meat was diverse, as one single piece of meat can be cooked in a number of different ways.

"… I enjoy eating it [meat], I find it easy to make meals that include it, I know it's good for you, and it's easy to get more variety out of same things, I can buy a piece of chicken or a piece of fish and I can do loads of different things with it … yeah just enjoy the taste really." (Beth, community panel)

Consideration for health was another major factor driving meat consumption. Eating a healthy diet was important to participants and many stated that eating meat contributed to a balanced diet. Participants indicated that meat provides the body with important nutrients and is an important source of protein. Many participants also felt that meat provided them with more energy. Interestingly, one participant indicated that she did not enjoy eating meat and ate it purely for health reasons. Following from this, perceptions of meat being healthy and nutrient rich appeared to act as a barrier to meat reduction, as some participants felt that they would lack certain nutrients if they reduced their meat intake or eliminated meat from their diet.

"I guess it gives you like a bit more energy because it's got protein in it. I feel like it's quite healthy to eat meat... I think it's quite hard, if you're vegetarian, to get enough protein in your diet" (Becky, community panel)

4.2.1.2 Identity

Interestingly, although participants enjoyed eating meat and felt that eating meat was an important part of their diet, many did not feel that eating meat was an important part of their identity. This is in line with existing literature, indicating that being a meat-eater is taken for granted in countries where meat consumption is a standard practice, such as in the UK (de Boer et al., 2017). It is argued that meat-consumption becomes a conventional dietary pattern in countries where it is readily available and affordable, therefore consumers do not need to reflect on their meat consumption as it is viewed as being '*normal*' (de Boer et al., 2017; Piazza et al., 2015).

"No I wouldn't say that, I wouldn't say like it [eating meat] was one of the most important things about me, or like I don't think people would describe me as you know, someone who is always eating meat or anything like that (laughs). So no I, I wouldn't say in me as a person it was that important." (Karen, Gym)

4.2.1.3 Habit

Following from this, meat consumption appeared to be an unquestioned dietary habit rather than a conscious choice for many participants. Almost all participants stated that they had been raised to eat meat and had subsequently continued to include meat in their diet as an adult. Participants did not recall making any conscious decision to include meat in their diet, but rather viewed this as a natural progression from their childhood. This is in line with the findings of multiple studies demonstrating habit to be a main driver of meat consumption (e.g. Bastian & Loughnan, 2017; Bohm, Lindblom, Åbacka, Bengs, & Hörnell, 2015; Piazza et al., 2015; Schösler, de Boer, & Boersema, 2014). For example, de Boer et al. (2017) argue that meat consumption is based on 'decision-rules' that are repeatedly applied, rather than being a choice that is considered on every relevant occasion.

"*I've just always eaten meat, I like the taste and yeah I've just always eaten it so it is, habit."* (Amy, community panel)

Upbringing appeared to play an important role in shaping participants' dietary habits. All meat-eating participants had been raised in a household where at least one parent regularly consumed meat and this appeared to inform participants' basic understanding of meal structure. Many participants felt that meat was central to meals, where dishes that did not contain meat were viewed as '*missing something'*. This is not surprising given that, in Western culture, meat is the central component of most meals (Douglas, 1972; Lentz et al., 2018; Riley 2010). In some cases, participants had continued to eat the same meals they had eaten when they were younger, illustrating the influence that participants' upbringing had on their later dietary habits. For example, one participant explained that she eats meat habitually as a result of specific recipes that have been handed down to her.

"… I feel it's not really a proper meal if it doesn't have meat in it." (Becky, community panel).

"*I suppose it's habit, I think, that a lot of the food that I make contains meat so what with Bolognese sauce or chilli or curry and things like that I think it's just recipes that have sort of been handed down to me, or stuff that I know I like so, I tend to use those recipes*." (Katie, community panel)

Habitual meat consumption also appeared to act as a barrier to meat reduction. Some participants mentioned that reducing their meat intake would be difficult and require a complete change of daily routine.

“ [*Eating less meat would be*] *definitely difficult…. just the complete change of habit… it's part of my routine, I think it would be just adapting to that, in a sense.*” (Amy, community panel)

4.2.1.4 Household consumption and Social norms

The diet of other household members appeared to play an important role in shaping social norms surrounding the appropriateness of eating meat. As mentioned above, most participants were raised to eat meat. Following this, participants appeared to be more likely to consume meat when living with other meat-eaters, and some found it difficult to reduce their meat consumption as a result. This appeared to result from a combination of there being a lack of alternative (vegetarian) food options available, as well as an increased social pressure to eat meat. For example, one participant recalled that she did not like eating meat as a child but felt ‘*forced’* to eat it by her parents. The participant explained that her family were meat-eaters who viewed those who did not eat meat as being ‘*weird*’. The participant therefore felt pressured to consume meat in order to adhere to her family’s expectations.

“*I was kind of forced to eat meat when I was younger because my dad came from a farm and if you didn't eat meat in the family you were weird… Sunday dinners were the worst times ever because I would just, wouldn't finish my meals, and they'd make me sit at the table for hours, but chicken I can kind of cope with, it's ok (laughs*).” (Hannah, community panel)

One participant recalled that she had eaten a vegetarian diet whilst living with her vegetarian mother but had re-introduced meat into her diet after staying with her father who ate meat. In this case, the participant appeared to adhere to the social norm of the household in which she was living. The same participant mentioned that she had experiences where she felt ‘*awkward’* being vegetarian around other meat-eaters and over time decided to re-introduce meat into her diet, commenting that this was a lot ‘*easier’*.

“*My mum has always been a vegetarian … I was vegetarian for about 3 or 4 years, I think it started just cos of what food was available in the house really, if my mum was doing the shopping there wasn’t that much meat around so I started not eating it a lot and then … but then I think I went away I’d say and I spent more time with my dad and started eating meat again. I think it was just, in like restaurants and different things and I remember going round to like different friends’ houses and boyfriends houses, and not being able to eat the things, that say the parents wanted to cook for dinner, and I would always find that really awkward, so yeah and I just, I think one day just wanted to try eating meat again and I did, and I enjoyed it and I definitely find it a lot easier now.”* (Beth, community panel)

Wider cultural norms also appeared to motivate participants’ meat consumption. Specifically, tradition and religious occasions appeared to make existing social norms surrounding the appropriateness of eating meat salient for participants. Some participants recalled feeling pressured to eat meat on Sundays, as a result of traditional ‘Sunday dinners’ in the UK, which features roasted meat as the centrepiece. As reported in the above section, Hannah recalled ‘*Sunday dinners were the worst’* when describing her experience feeling pressured to eat meat when she was younger. It has been argued that the use of meat in traditional and religious contexts motivates meat consumption in a similar way to habitual meat-eating, as the role of meat in these contexts is unquestioned and even viewed as being central to the tradition itself (Bastian & Loughnan, 2017). Indeed, one participant mentioned that she had eaten more meat than usual during Christmas stating that a Christmas without meat would be ‘*pointless’,* emphasising the central role that meat plays in this holiday.

“… the first semester I think I ate meat more, and obviously Christmas was there so, Christmas without meat (laughs) what's the point.” (Georgia, people and planet)

4.2.2 Awareness of the negative environmental impacts of meat

All of the meat-eating participants felt that their diet impacted on the environment in some way. Similar to past research (Macdiarmid et al., 2016), participants tended to focus on the negative impacts of buying foods imported from other countries, the packaging used to wrap foods, and the energy used to process different foods. However, participants did not mention the impact of meat consumption on climate change.

"*Yes because I buy stuff from supermarkets that is packaged and I buy stuff that you know is from different parts of the world but has been transported, you know and created like a carbon footprint I guess, so, yes, I think it, it would have an impact."* (Karen, Gym)

Few meat-eating participants linked meat consumption with specific environmental issues and only two participants associated meat consumption with greenhouse gas emissions. No participant explicitly linked meat consumption with climate change, although this might be insinuated from the association with greenhouse gases. In line with past literature (e.g. Bailey, et al., 2014; de Boer, de Witt, & Aiking, 2016; Macdiarmid et al., 2016; Tobler et al., 2011; Truelove & Parks, 2012), the majority of participants appeared to be unsure about how meat impacted the environment and to what extent.

"*I don't know to be honest I know that eating meat and fish does [impact the environment], but I don't really understand like in what sort of way*." (Becky, community panel)

Other meat-eating participants were sceptical and did not believe that meat consumption negatively impacted upon the environment. Some participants viewed plant-based diets as having an equally negative or an even worse impact on the environment, compared to diets that include meat. One participant also commented that information relating to the environmental impacts of meat consumption should be taken ‘*with a pinch of salt*’, indicating that information, particularly from ‘*vegan websites*’ might not be reputable.

“*I wouldn't really say overall it has a huge impact …* I *know that supposedly eating meat is damaging to the environment, but then only eating a plant-based diet, that's not necessarily good either, so it's kind of a swings and roundabouts situation*.*”* (Amy, community panel)

“*Obviously you have to take things with a pinch of salt, because, you can read like a lot of vegan websites and it can be quite radical so they can, you know say a lot of things you don't know how much truth is behind them.”* (Olivia, Gym)

4.2.3 Motives driving meat reduction

4.2.3.1 Price & taste

Participants were asked whether they included any meat-free meals in their diet and their reasons for doing so. Many participants stated that they ate meat-free meals for their lunch and some participants chose to eat meat-free dishes for their evening meal. Participants tended to eat meat-free meals for reasons relating to cost and taste. Many participants commented that eating meat was expensive and felt that eating meat-free meals saved money. This is supported by other research, where the high cost of meat was found to be a prominent motivating factor for meat reduction (Lentz et al., 2018).

“*I guess meat can be quite expensive every day, probably make my food bills a lot higher, and stir-fries and different things I don't feel like they need the meat.”* (Beth, community panel)

Participants also felt that some meals did not need to include meat and that eating meat-free meals added more variety.

"I do enjoy salads with like nuts and things in, so I don't always miss it [meat], I just like a bit of variety I guess, so yeah I guess if I was having meat at every meal I probably would be a bit like oh this is a bit repetitive sort of thing." (Karen, gym)

It became clear that some meat-eating participants already tried to limit their meat consumption and avoided eating certain types of meat, namely red and processed meat. Meat reduction appeared to be motivated by concern for health, social norms, disgust and environmental concern.

4.2.3.2 Health

Health was an important factor found to motivate meat-reduction among meat-eating participants. Participants appeared to be concerned about the negative health implications associated with eating too much red meat specifically. As a result, some participants tried to reduce their red meat consumption and replaced red meat with other foods, such as white meat or fish.

"I take into consideration trying not to have not red meat too often so, I'll try and mix it up like with turkey and chicken and fish as well … I'm aware of, you know health stories and the press and things about too much red meat links to heart disease or, you know omega-3 is really good so you should have more fish and things like that and I'm just quite interested in that, that's what sort of drives me I guess." (Karen, gym)

Some participants were also concerned about the health risks associated with handling raw meat and cooking meat products from frozen. As a result, participants occasionally chose to eat meals that did not include meat, including plant-based meat alternatives, which participants considered to be safer to cook from frozen.

"… It's easier to reheat a meal that doesn't have any meat in it because there's less chance of getting ill." (Becky, community panel)

It is interesting to note that concern for health emerged as a motive both for and against meat consumption. Similar findings have been reported by de Boer et al. (2017), who argue that this might represent “a choice for eating meat without overdoing it” (p.27). In other words, concern for health may represent a motive for eating meat in moderation, so that participants can benefit from the nutrients provided from meat, whilst reducing the negative health impacts associated with eating high amounts of red and processed meat.

4.2.3.3 Environment

One participant indicated that she actively limited their meat consumption for issues relating to the environment and tried to avoid beef specifically for this reason.

“I try to reduce my meat consumption … yeah, I like the taste of it, but it's more like, my environmental concern you know because I think meat is not really sustainable for long term, so I try to reduce [my] consumption, because of that and I think it’s better for the health not to eat too much meat… I'm really trying to avoid beef for example… cos beef I think is the worst meat ever for environmental concern”.

(Georgia, people and planet)

Thus, although it was not a common motive among participants, the results showed that environmental reasons can play a role in motivating meat reduction among meat-eaters, if individuals perceive meat to have a negative impact on the environment.

4.2.3.4 Household consumption and Social norms

As mentioned previously, the diets of others in the household appeared to play an important role in shaping participants’ dietary habits in relation to meat consumption. Interestingly, participants’ upbringing also appeared to motivate meat reduction, in cases where participants were raised in households with a meat-free parent. One participant consumed very little meat, but ate fish, as part of a pescatarian diet. Interestingly, the participant recalled having a vegetarian mother and eating mostly vegetarian dishes when she was growing up, although the participant acknowledged that she always had the option to eat meat. Being exposed to vegetarian dishes seemed to shape the participants' later dietary choices, as she stated, "*that's how I've always eaten*".

"*I didn't used to eat meat when I was younger really, when I was about 8 to 11 I used to have sausages and things, but my mum's a vegetarian so, I could always eat meat if I wanted it cos she would cook meat for my dad, but, there was always sort of a vegetarian option which I would choose to have … she never like pushed any agenda on me or anything we just sort of didn't eat it … that's how I've always eaten to be honest.*" (Olivia, Gym)

Another participant disliked red meat and attributed this to the fact that she was not '*exposed*' to it for a period of time when she was younger as a result of a diet that her mother was on. The participant found that she no longer enjoyed eating red meat after it had been re-introduced to her diet.

"*I think it's because when I was younger my mum went on a diet and she cut all red meat out of her diet and so for so long I wasn't kind of exposed to it, and then when it was re-introduced into my diet I just did not like it at all. I find it really quite greasy, and yeah the taste, the texture, no none of it (laughs) ….*" (Hannah, community panel)

4.2.3.5 Disgust

Although participants enjoyed eating meat and felt it was an important part of their diet, many of the meat-eating participants disliked and avoided eating certain cuts and types of meat, especially red meat. Participants appeared to be particularly disgusted by features linking meat with its animal origin, such as bone, veins or blood. This is in line with the results of several studies demonstrating that consumers are sensitive to reminders of the animal origin of meat and in some cases, resolve the issue by avoiding meat (e.g. Hoogland, de Boer, & Boersema, 2005; Schröder & McEachern, 2004; Tian, Hilton, & Becker, 2016).

> "*…I just, I don't like the taste of it, I don't like cooking it, I don't like the smell (laughs) of it, so, I just, I don't find it particularly appetizing… like the blood, I wouldn't eat things on the bone, it just makes me feel a bit sick, it's not appetizing to me, to know that it's come from an animal, obviously it has, but I know that but it's just my logic, I just don't find it appetizing if I can see that it's from an animal. I like don't eat steak like I've never tried steak cos the thought of the sort of blood coming out of it isn't something that I find appealing and it's, the like tough texture of it I, don't, I don't want to eat that basically.*" (Olivia, Gym)

Another participant avoided eating meat from the bone and indicated that she did not like to be reminded of the fact that meat has come from a living animal.

> "*I suppose I'm quite fussy I still don't like eating meat off the bone and different things, I'm not sure why, I guess cos I know sort of what I'm eating…*" (Beth, community panel)

4.2.4 Willingness to eat less meat

Meat-eating participants were asked whether they would be willing to reduce their meat intake (further) or even eliminate meat from their diet entirely, for a number of different reasons relating to health, animal welfare, the environment and to benefit the welfare of workers. Participants were also asked which of these issues would be the most influential in encouraging them to reduce their meat-intake.

4.2.4.1 Health

Overall, participants stated that they would be the most willing to reduce their meat intake for reasons relating to health. All participants said that they would be willing to reduce their meat intake if they thought it would be better for their health and some participants indicated that they would even eliminate it from their diet completely for this reason, though participants indicated that this would not be easy.

"If I got told that it [reducing meat] was better for my health then yeah I would consider it, I'd probably find it more difficult to get variety in the meals that I'm making, but … If I got told that the detriment to my health was a very big, so if I got told that I really shouldn't eat it [meat] then yeah I would give it up, but other than that if it was just things like say oh they found out it had a really high fat content I probably would still eat it sometimes, just for the variety really."(Beth, community panel).

The negative health impacts associated with meat consumption appeared to be more effective in persuading participants to reduce their meat intake than environmental factors. Participants were less willing to reduce their meat consumption for environmental reasons and indicated that their health would be a more influential factor. In line with past literature, this appeared to result, in some cases, from the fact that eating less meat would have a direct impact upon the participants' health, whereas the environmental impacts of meat are comparatively more abstract (Amelung et al., 2019).

"From a selfish point of view probably, it would have more impact on my health because that is me and that's you know an immediate thing that I can see and that obviously relates to me from a selfish point so, I would probably care more about that than maybe the environment." (Karen, Gym)

4.2.4.2 Environment

Participants were less willing to reduce their meat consumption for environmental reasons and were not willing to eliminate meat from their diet entirely for this reason. It became clear that participants would need to be very convinced that reducing their meat-intake would have a positive impact on the environment, in order for them to change their diet. This supports past literature demonstrating that participants' willingness to limit their meat consumption is associated with the extent to which they perceive meat as having a negative impact on the environment (de Boer, et al., 2016; Truelove et al., 2012).

"*If the difference was really great then I'd probably cut down a little bit, but just based on environmental things no I probably wouldn't cut it out completely*." (Beth, community panel)

Part of participants' reluctance to reduce their meat consumption for environmental reasons stemmed from the fact that they were not convinced reducing their meat consumption would have a positive impact on the environment. Many participants were sceptical and stated that they would need to see scientific evidence supporting this link, before they would consider reducing their meat intake. Participants also felt that changing their personal consumption of meat would have little positive impact.

"*It would have to be like, find specific evidence, they would have to have studied it and sort of proven it for me to be convinced*." (Amy, community panel)

"*I guess I would be willing, I don't know. I know it sounds bad but I think just one person doing it isn't really going to do anything about it*." (Becky, community panel)

These findings are similar to those reported by Macdiarmid et al. (2016), who found that participants lacked awareness of the link between meat consumption and climate change, believed that their personal consumption of meat would play a minimal role in mitigating climate change, were sceptical of evidence relating to the negative environmental impact of meat consumption and were resistant to the idea of reducing their meat consumption as a climate change strategy.

4.2.4.3 Animal welfare

Meat-eating participants were reluctant to reduce their meat consumption for reasons relating to animal welfare. Participants mostly indicated that they would try to buy products with higher welfare standards rather than reducing meat from their diet, or would stop eating a specific type of meat (e.g. poultry) if it was associated with poor welfare standards, rather than reducing their consumption of meat more generally.

"*If I did find out that say the poultry industry was really, really horrible or something then I'd probably give up that like one sort of section of meat if you get what I mean … and sort of yeah the standards of the meat that they were producing, if yeah I say the cuts of meat that they were providing were really bad as well and yeah the animal welfare standards as well.*" (Beth, community panel)

However, participants often indicated that welfare standards would have to be '*really bad'* in order to motivate dietary change. Following from this, some stated that they would be more inclined to reduce their meat intake for animal welfare if there were more media campaigns about this issue, especially if information was displayed in a shocking way and made participants feel guilty. In many cases, participants were already aware of cases where meat production had been associated with poor welfare standards, but found that this did not influence their behaviour. This is reflective of psychological literature on attitudinal ambivalence and the so-called meat-paradox, which explains how individuals rationalize eating meat despite viewing issues such as animal welfare negatively (e.g. Berndsen & van der Plight, 2003; Loughnan, et al., 2010).

"*Yeah I guess it would be how it was displayed to me as well because I know a lot of the time they are treated quite poorly but if suddenly something else was to happen, I guess … Because I know like, what you see like videos on like the internet and different things of like farming or things they show you in school about the farming industry but if you're not constantly reminded of that or it's not presented* *as harshly then it doesn't really influence you as much, you'd feel sad for a little bit but it's not enough to make you stop eating meat, especially if other people are cooking for you and things … if you were trying to get people to stop eating meat or show really how the farming industry is then yeah I guess yeah more dramatic and yeah the sort of gory it's like not cutting out some of the fine details you might miss out*." (Beth, community panel)

4.2.4.4 Welfare of workers

Meat-eating participants were also asked whether they would be willing to reduce their meat-intake if it would be beneficial for the farmers producing the meat. For example, if farmers were being treated unfairly. Most participants stated that they would be willing to reduce their meat consumption to benefit farmers, although these issues were not at the forefront of participants' minds.

"Yeah I think, yeah I think that is important, I don't know any farmers personally so maybe, that isn't something that I think about as much maybe, so probably that would be the lesser one for me." (Karen, Gym)

One participant was already aware of issues surrounding the welfare of workers, particularly in France. However, the participant noted the complexity of the issue, as rearing livestock to produce meat is the primary source of income for many farmers and reducing or boycotting produce from unfairly treated workers could result in a loss of pay for workers. This participant concluded that whether she would reduce her meat intake to support this cause would depend on the kind of evidence provided.

"*In France we have many problems with working conditions of farmers so I would say yes, but, I think this idea is quite difficult to really look at properly because some farmers would say ok it's bad for my working conditions and others would say oh but it's, thanks to meat I can earn my life and I can feed my children or I can feed* *myself and I can live properly, so I would say yes but it would depend on, the kind of evidence I can have including that."* (Georgia, people and planet)

One participant stated that the welfare of workers would be the most influential factor in encouraging her to reduce her meat intake.

"*Probably the farmers but the lives of the people looking after them and the people around, especially things that are coming from other countries, if I knew that that was impacting their, like me buying there was really impacting their lives if they weren't earning enough or getting their fair share then yeah I guess that influence me more, more the fair trade side of things."* (Beth, community panel)

4.2.5 Everything in moderation

Many meat-eating participants stated that although they would be willing to reduce their meat intake for different reasons, as noted above, they would not be willing to eliminate meat from their diet entirely. Participants were more willing to reduce their meat intake to a couple of portions per week, as many felt that it was healthier to eat '*everything in moderation*'. Similar to this, some participants commented that they could eliminate meat from their diet for a set period of time but could not do this permanently.

" I would say not to get rid of it completely… I prefer to eat everything but with less quantity you know." (Georgia, people and planet)

"I wouldn't mind if it was for a certain period of time but I don't know if I would want to do it for the rest of my life" (Becky, community panel).

4.2.6 Willing but not doing

As noted in the previous section (4.2.4), participants appeared to be concerned about issues relating to their health, animal welfare, the environment and the welfare of workers, and many stated they would be willing to reduce their meat consumption for these reasons. However, few participants had taken any action to reduce their meat-intake. There was therefore an inconsistency between participants' attitude and behaviour. Some participants discussed this during the interview. For example, one participant noted that she continued to eat meat despite the fact she perceived herself as being environmentally conscious.

"I think it [meat] is [bad for the environment], but it doesn't stop me at the moment I guess, but this conversation is making me think twice actually (laughing) so I might go away and be like ok, [I] need to think, so yeah I think, if I stopped and I really thought about it then perhaps yeah the environment would you know, cos I'm saying I care about the environment so yeah it should, it should make me think about it yeah." (Karen, Gym)

Other participants commented that they were aware and concerned about the poor animal welfare standards associated with meat production, but that this did not prevent them from eating meat.

"I struggle with this all because I think as a meat eater you know like, I do say I care about animal welfare but then obviously as a meat eater you know, I'm still willing to eat meat, so, it's a difficult one, I think, I am more aware of animal welfare, now and I think I would be conscious to think about that as well." (Karen, Gym)

There were many occasions throughout the interviews where participants commented that although they cared about issues relating to the environment and animal welfare, these issues were not salient to participants whilst they shopped for food. For example, one participant commented that although her mother purchases items with higher animal welfare standards (from the label '*Red Tractor*'), animal welfare does not '*cross her mind*' when shopping for food.

"My mums always brought like 'red tractor' things, so we've always eaten things like that, but it doesn't really cross my mind when I'm shopping." (Amy, community panel)

Another participant commented that animal welfare is not something that affects her purchasing behaviour.

"Yeah I'd say it's something that I think about but it's not at the forefront of my decision making." (Hannah, community panel)

Another participant similarly commented that she does not tend to think about the environmental impacts of different foods whilst doing her shopping.

"I think with country of origin and the environment I never really think about how that's affecting it or anything or I don't even notice where the foods come from, what I'm buying." (Becky, community panel)

This contributes to an understanding of why most participants did not limit their meat consumption despite being concerned about issues relating to animal welfare and the environment, as it appeared that these factors were not salient to participants whilst they shopped for food. Indeed, it has been argued that the connection between food and its production is lost, as consumers view food as appearing in supermarkets without considering how it got there (Berndsen & Pligt, 2004).

4.2.7 Perceived responsibility

Participants were asked who they thought is responsible for ensuring that food is not environmentally damaging, for example by mitigating food related greenhouse gas emissions. Most meat-eating participants viewed external bodies to be responsible, including supermarkets and food producers, government and environmental organisations. Following from this, participants tended to focus on the role of supply-side mitigation strategies as a solution. This supports existing literature demonstrating that meat-eaters tend to displace personal responsibility concerning the impacts of meat consumption and instead attribute accountability to mass production (Graça, Calheiros, & Oliveira, 2014).

"I'd say some sort of environmental agency … I think there should be standards on the way food is produced, so what's allowed to be used on foods, and it's difficult for them to put a restriction on how far food can travel but, definitely encourage locally produced foods, and maybe set up some sort of link between, where food is produced and where needs that…." (Hannah, Community panel)

On the other hand, some participants did indicate the role of the consumer in minimizing the environmental impact associated with food. These participants felt that it was up to consumers to buy more environmentally friendly products and to avoid unsustainable products, as a way of influencing supply.

" I think, in my opinion it would be the consumer [who is responsible], because people choose what they want to eat and, I think if people, were asking themselves ok, I want to eat this kind of food because it's better for the environment, and I think, if the will, comes from the consumer, then the producer would need to adapt themselves to, you know to meet the needs of the consumer, yeah." (Georgia, people and planet)

However, participants also commented that their ability to mitigate food's environmental impact through their dietary choices is dictated by the selection of food available to them. Thus, participants felt that although individual consumers can make a difference, this is ultimately limited by the supply chain.

"*I guess the supply of all the different things they put in the supermarkets, cos people will buy what's there...*" (Beth, community panel)

4.2.8 Section summary

In sum, the interviews with meat-eating participants showed that meat consumption appeared to be driven by taste, concern for health, habit and social norms, with these factors also acting as barriers to meat reduction. Participants had some awareness of the negative impacts of meat consumption on the environment, but did not tend to recognise the contribution of meat production to climate change, and underestimated the potential for a reduced meat diet to mitigate this effect. Participants were the most willing to reduce their meat consumption for their health and were in favour of reducing their meat consumption rather than eliminating meat from their diet entirely.

4.3 Motives driving meat reduction and awareness of the negative environmental impacts of meat, among meat-free participants

4.3.1 Motives for meat reduction

The following sections report on the findings from interviews with meat-free (vegan and vegetarian) participants, to investigate the motives for meat reduction and awareness of the negative environmental impacts of meat among individuals who exclude meat from their diet. Meat-free participants were asked what motivated them to stop eating meat. The words most commonly used in response to this question are summarised in Figure 4.

Figure 4. Word cloud representing meat-free participants' motives for adopting a meat-free diet.

Note. The frequency of words in participant responses is depicted by size, where more frequently chosen words are depicted in a larger font than less frequently chosen words.

Participants tended to list a number of different reasons for deciding to adopt a meat-free diet. In line with existing literature (e.g. Ruby, 2012), the main motive encouraging participants to eliminate meat from their diet was concern for animal welfare, although reasons relating to health and the environment played an important role in reinforcing this decision.

4.3.1.1 Animal Welfare

The main motive for participants to adopt a meat-free diet was animal welfare. Many participants with a meat-free diet believed that animals reared for meat and dairy consumption are raised in inhumane conditions and that the slaughter of animals for human consumption is morally wrong. This supports previous research which has also demonstrated concerns about the raising and slaughtering of animals to be one of the most frequently reported motivations for vegetarianism (Ruby, 2012). Following from this, many participants provided vivid and detailed explanations of the different ways in which animals raised for slaughter are thought to suffer. Participants often commented that they did not want to *contribute* to the suffering of animals and eliminated meat and other animal products from their diet for this reason.

"The, male chicks are just put in grinders or suffocated in bins bags, and the females are just sent on conveyer belts and reared in just despicable environments really, and any chickens that are bread for food for meat are just haled up just terrible, terrible conditions … so that's the eggs. The dairy is around the way cows, the babies are forcibly removed from them … they have to take the babies away really quickly because the mother cows get absolutely distraught when, when their babies are taken away … if you have something with milk in it means that that's what's happened to the baby. There's a cycle route that I used to do, that goes past a farm, and at a particular time of the year all the baby cows are in, a field crying, and I don't really want to be a part of that anymore, I don't want to cause that anymore, so that's the dairy stuff and, and just the way that animals are kept, it's just horrific,

it is truly horrific, … and then the way the pigs are kept as well, it's, it's truly horrific and I just, it's not right, it's just not right." (Charlotte, Veganuary; vegan diet)

By not eating meat or other animal products, participants felt that they were helping to make a positive difference by reducing the overall number of animals that would be raised and slaughtered for human consumption. Following from this, some participants readily cited the number of animals that they had *saved* as a result of not eating meat.

"There's a lot of little calculators you can use online … it can show you the estimate of say, not the number of animals you've saved per-se but how many you've stopped come into breeding for that person kind of thing, so, for 9 months I think it was something around 950 animals or something." (Lucy, Cardiff vegans; vegan diet)

Most participants had been made aware of issues relating to animal welfare through a variety of sources including books, word of mouth, online research and in particular, documentaries. Footage showing poor welfare conditions and the slaughter of animals appeared to be the most influential factor contributing to participants decisions to eliminate meat and/or other animal products from their diet.

"I watched like 'earthlings' in August, and I was like oh my God like, this is the worst thing ever. So I was like, I want to just be a vegan now." (Chris, Cardiff vegans)

Some participants became meat-free at a very young age after watching footage of this kind. These participants recalled being so shocked by what they had seen that they never wanted to eat meat again.

"I started [being vegetarian] when I was about 6, I have an older sister and she took it upon herself to show me a nice video and then we both went vegetarian (laughs) … it was a slaughter house, I just remember seeing the first bit and thinking that I

really liked pigs and really liked going to the farm and just like really liked animals and still do and couldn't really comprehend that, it was actually, like a pig that I wanted to be like friends with … and that I was kind of eating it and that I was the cause of its death and I would be the cause of its suffering." (Angela, Cardiff vegans; vegetarian diet)

"*I remember I was in year 8 and I remember I had ham sandwiches in my bag, and we were going to watch a video of an abattoir in science class, so I remember making a joke, like ' oh yeah this will get me ready for my dinner, ha ha ha' and then I watched the video and I never ate meat ever again, I was horrified, it like scared me, I didn't even finish my ham sandwich, I had to give them away, and yeah so I never ate meat ever again after that first, abattoir watching video."* (Anna, Cardiff vegans; vegan diet)

4.3.1.2 Animals as sentient beings

The link between meat and animal origin appeared to be very salient to meat-free participants. These participants did not view animals as a source of food, but instead viewed them as sentient beings. In contrast to the meat-eating participants who appeared to be detached from the source of meat, meat-free participants viewed meat as '*having a face'*.

"… *I just see it as fundamentally unethical to eat animals, it's something which really, it, it, it almost like makes me angry cos I've been to slaughter houses, I've seen the animals up close for like vigils and stuff that I go to, and it really illustrated to me, and reinforced the narrative that my meat has a face, like meet your meat is a slogan, and it just made me really uncomfortable*." (Chris, Cardiff vegans*; vegetarian diet*)

Another participant emphasized that animals have *'feelings'*, drawing similarities between animals that are raised for slaughter and those that are kept as pets.

"I don't know, animals have feelings really and I don't feel, I've never really understood why people might keep like a house pet like a cat and like love it and then eat a cow, I don't know." (Angela, Cardiff vegans; vegetarian diet)

Animal welfare was also the main reason why some participants had initially shifted from a vegetarian to vegan diet. A number of participants recalled that they had felt hypocritical avoiding meat for ethical reasons, whilst consuming other animal products such as eggs or dairy, as part of a vegetarian diet. These participants had felt that they were still contributing to the poor living standards of animals by consuming these products, and subsequently eliminated them from their diet by becoming vegan, to act in a way that was more consistent with their attitudes. Some participants indicated that they felt relieved after resolving this psychological discomfort, also known as cognitive dissonance (Festinger, 1957).

"*It was all about animal welfare because I had been reading for quite a few years about how, the dairy industry and poultry farming and that type of thing and I knew what was happening in animal welfare terms but I was still eating eggs and consuming bits of cheese you know and that type of thing and it wasn't, it didn't sit right psychologically. So, when I decided to become vegan I felt a lot lighter, not feeling responsible for consuming something that had got to my plate in a way that I wasn't happy with. So, I just felt um, psychologically a lot easier with what I was eating."* (Amelia, Veganuary; vegan diet)

"*It's always been about animal welfare that's the whole reason I became vegetarian when I was a child and it's always been at the back of my mind … and sort of being guilty, so to be honest now I've done it again [become vegan], it's a bit of a relief really, cos I don't feel it hanging over me anymore that guilt, every time I have a cup of tea with milk in it I don't feel guilty anymore so, you know, that that's, that's the number one reason for me, it's been animal welfare…. it just feels nice now, you know in my head I feel that i'm doing what I should be doing*" (Zoe, Veganuary; vegan diet)

4.3.1.3 Meat and dairy as a business

Meat-free participants viewed the slaughter of animals as being cruel and unnecessary. Contrasting sharply to the interviews with meat-eating participants, meat-free participants stated that meat was not essential to a healthy diet.

"I think the main reason why I actually became vegetarian was because I didn't feel like it was morally right or necessary to kill another kind of like live being for your benefit really, particularly now that there's so many alternatives to eating meat and I just don't feel like it's really an important part of your diet". (Angela, Cardiff vegans)

Some participants viewed the public as being manipulated by businesses. These participants felt that businesses exaggerated the health benefits of meat and dairy products in order to promote sales. For example, meat-free participants often commented that cow's milk is marketed as being important for human development, while many thought that this was not the case. Instead, participants felt that human consumption of cow's milk is both unnecessary and unnatural.

"*I thought dairy was important for us to eat, I sort of very much bought into the sort of lies I feel like we're sold that dairy is integral for us to grow healthy bodies … I feel like drinking dairy is quite a strange thing to do, and we've kind of been socialised into believing that its ok and it's healthy and it's what we should be eating. In work sometimes I get sort of healthy food leaflets from companies and they'll say things like it's really important to be drinking dairy until a certain age, but the research is sponsored by dairy companies which I find sort of deeply disturbing... it's very strange… it's almost as if, we've kind of entered into some kind of like conspiracy world where they're trying to sell us things that are really bad for us just for the sake of money which is quite scary."* (Anna, Cardiff vegans; vegan diet)

Participants felt particularly uncomfortable with the business aspect of meat and dairy production. Poor animal welfare standards were attributed to the perception that, in Western cultures, animals are treated as products for consumption rather than as sentient beings. Participants viewed livestock as being raised in a way that maximises profit at the expense of animals' wellbeing.

"…because we just mass produce meat and to make the largest profit possible these companies will try and streamline their production processes, so they won't invest in good quality conditions for the animals, they won't invest in anything like that, they'll just, go with the cheapest possible ways to produce so they can make the maximum amount of profit." (Chris, Cardiff vegans; vegetarian diet)

"I kind of thought how can the demand for meat and dairy be so ethical if it's so unsustainable so I watched a lot of documentaries did a lot of research and just kind of found out that basically you know, whether they're harmed or in complete agony or in terror, all their lives or whatever it doesn't matter because they are a number and it's about all the profit which obviously very upsetting but it's also the business aspect that shocked me that we're capable of doing that much when so many people don't know about it. I think that was what did it." (Lucy, Cardiff vegans; vegan diet)

4.3.1.4 Waste

Some meat-free participants also commented that the meat industry was wasteful in addition to being cruel. These participants explained how animals' lives and bodies are wasted in some production processes, such as the killing and disposing of male chicks in the egg industry.

"*It's very stressful for the animals, and the amount of waste that we have is quite grotesque I suppose, especially with things like male chicks just literally being ground up in the process of, the egg industry, so I find that sort of deeply disturbing… and the more I found out the more I was sort of thinking to myself, this* *is not normal, we should not be eating like this, it's, it's, it's just sort of quite grotesque, it was like [a] systematic holocaust of animals, it's bizarre to me*" (Anna, Cardiff vegans; vegan diet)

Participants also discussed food waste associated with meat consumption, commenting that it is especially wasteful to kill an animal and then throw away the meat. One participant felt so strongly against food waste that she followed what she referred to as a 'freegan diet'. This participant identified as a vegan and indicated that she would not purchase meat, fish, dairy or other animal products herself, but would consume these foods if they were going to be thrown away. The participant described eating meat that her housemates would otherwise throw away and eating other people's leftover food at restaurants.

".... it has become quite radical sometimes but even in restaurants when you see that some people (laughs) don't eat up their stuff although it's completely fine and you know it's going to be thrown away, and restaurants have to throw away so much food and ah, it makes me crazy (laughs). Yeah … either when I'm there with my friends and I know she has a similar attitude then we either wait until the people are gone and then well eat the food before the waiter comes, or we ask the people whether they still want it because it will be thrown away afterwards and most people react very very friendly, sometimes people even (laughs), when they see that we do that they even bring food to us, they're like' oh we don't want it anymore do you want it' (laughing)." (Emma, people and planet; vegan diet)

The participant explained that she did not feel bad consuming meat or other animal products, despite being fundamentally against the use and slaughter of animals for human consumption. This is because the participant felt that she was not contributing to the slaughter of animals by consuming animal products that had already been purchased and would otherwise be wasted. The participant also felt that she was reducing overall food waste by doing this. Interestingly, previous research has also illustrated that whether vegetarians feel incongruent as a result of occasionally eating meat depends on the individual's diet rules, which they have set for themselves (Hoffman, Stallings, Bessinger, & Brooks, 2013). In this case, the participant did not feel guilty for consuming meat if it would otherwise be wasted.

" I don't feel bad about it if I know that it would've been thrown away otherwise … because if you eat something that would have been thrown away then it means that you buy less, so less would be consumed, which is in general, better." (Emma, people and planet; vegan diet)

4.3.1.5 Health

Interestingly, health did not appear to be a main factor driving meat-free participants' decisions to give up meat or other animal products. This contrasts with the interviews with meat-eating participants where health was one of the main reasons why participants limited, or would be willing to limit, their meat consumption. However, although health did not initially drive meat-free participants' decisions to stop eating meat, many participants did comment on the negative health implications associated with meat consumption and the positive health impacts associated with having a vegetarian or vegan diet. Participants often cited evidence that eating a vegetarian or vegan diet was healthier than eating meat. This appeared to reinforce participants' decisions to not eat meat.

"*I know 100% that eating a plant-based diet is far more healthy, there's so many academic studies which have proven this, more and more research is coming out every year saying, the world health organisation coming out saying that meat is carcinogenic, especially red meat is very carcinogenic, it will give you cancer, knowing full well the level of antibiotics and stuff which is used for meat industry, after attending 'veg fest' and stuff like that and just knowing that, knowing about this information, for me there is absolutely 100% no way that I would ever go back to being a, meat eater, no I don't think so."* (Chris, Cardiff vegans*; vegetarian diet*)

Participants also often shared concerns about the use of hormones and antibiotics in animal products and negative health implications associated with this.

"*...the amount of chemicals that are used, to treat the animals that are kept in such cruel conditions as well. Cos they're pumped full of hormones and antibiotics, so, I mean that can't be good, anybody whose eaten loads of meat with loads of antibiotics in it, so there is a wider aspect of it.. have you heard, they're going on about, viruses that have become, resistant to antibiotics, then, if that's all, I mean I don't know, but it just doesn't seem right to me that we're pumping animals full of antibiotics and all these antibiotics are floating around our food chain really so, I wouldn't have thought it was that good*." (Charlotte, Veganuary; vegan diet)

Many participants also commented on the positive health effects they had experienced since eliminating animal products from their diet. Participants recalled that becoming meat-free had encouraged them to cook a greater variety of dishes. As a result, participants stated that they had shifted away from eating unhealthy convenience foods, to cooking new recipes from scratch. Moreover, participants described the different health benefits they had experienced after adopting a meat-free diet, including weight loss, clearer skin, thicker hair and higher energy levels.

"*Before I went vegan, I used to eat very unhealthily, so in turning vegan, I actually lost 6 stone over three years, which is quite impressive. So like I literally went from eating sort of steak and chips and burgers to eating a lot of vegetables, eating a lot of healthy foods, I mean kind of, being vegan kind of forces you to be healthier I suppose*" (Anna, Cardiff vegans; vegan diet)

"I'd say the health, the health impacts it's had on me has been absolutely fantastic in terms of like, giving me more energy, clearing up my skin, a lot of those things, and also in terms of diet before I became a vegetarian, I was a very sort of like nomadic cook, I was pretty terrible I was pretty lazy, I didn't really cook much, but now I've became a vegetarian, slowly veganising my diet, I've sort of been branching off into foods that I've never really cooked with before." (Chris, Cardiff vegans*; vegetarian diet*).

Therefore, although concern for health did not drive participants' initial decision to stop eating meat, the negative health impacts of meat and positive health impacts of vegetarian or vegan diets played an important role in reinforcing participants' decision to eat meat-free. This is in line with the findings of other qualitative research, which found that participants similarly described the health benefits they had experienced as a result of eliminating meat from their diet and used these to justify their decision for continuing to follow a meat-free diet (Fox & Ward, 2008a).

4.3.2 Identity

In contrast to the meat-eating participants, most meat-free participants stated that their diet was an important aspect of their identity. The ethical and moral values driving participants' decisions to eliminate meat from their diet were particularly important to participants' sense of self. Many participants felt that they were making a positive difference to the world by reducing animal suffering and environmental damage, as a result of following a meat-free diet.

"Being a vegetarian increasingly has become a great source of like pride and it is a very, very big part of my identity for me because I know that … I'm no-longer leading to the direct slaughter and suffering of animals…" (Chris, Cardiff vegans; vegetarian diet)

This was especially prominent among vegan participants, as being vegan was viewed as a lifestyle in addition to a dietary choice. Following from this, participants discussed avoiding products that are tested on animals and avoiding clothes made from animal by-products (e.g. leather). Participants indicated that they did not want to contribute to what they viewed as being the exploitation of animals, and also wanted to minimize their impact on the environment, in as many ways as possible.

"… I think being a vegan kind of encompasses like a way of life rather than just dietary sort of stuff, but I don't buy new clothes anymore, I only buy second-hand clothes, yeah just stuff like that really…" (Anna, Cardiff vegans; vegan diet)

The wider lifestyle choices associated with veganism led some participants to feel as though they could not label themselves as being vegan despite following a vegan diet. For example, one participant described himself as being vegetarian despite the fact that the participant was in the process of becoming vegan. He explained that he could not call himself a vegan, because he still consumed some animal products and possessed items of clothing made from animal by-products.

"I'd still class myself as a vegetarian because as soon as I eat a product which has involved the exploitation of an animal you can automatically rule yourself out as calling yourself a vegan, so, the fact that I still occasionally have pizza, the fact that I still have honey … there's still, shoes and belts I have which are leather which obviously when I become vegan I want to dispose of, although I don't wear it, I still have it in my possession so in terms of like by-products, there are by-products which I have which do contain ingredients which involve the exploitation of animals, because that is apparent, I can't call myself a vegan." (Chris, Cardiff vegans; vegetarian diet)

Another participant explained that she did not feel '*brave*' enough to call herself a vegan because she still wore clothes made from animal by-products. This participant felt that she would be judged by others if she called herself vegan as a result of this and instead referred to her diet as being plant-based.

"…I'll describe it just as a plant based diet, so I'm trying to, since January, become vegan, but I don't know if I'd be brave enough to use that term at the moment … yeah at the moment I'd just describe it as plant based… It's only because of, you know still wearing leather shoes and that sort of side of it, so, yeah it's just that. Because as soon as you say you're vegan then people want to make judgments sort

of about, other aspects of your life so you know that's sort of early days for me I would say describing myself as, a vegan" (Zoe, Veganuary; vegan diet).

Some participants appeared to view '*purity of motive*' as being fundamental to veganism. These participants felt that veganism should be defined not through specific behaviours, but through the motives guiding them. Specifically, these participants felt that actions needed to be guided by a desire to relieve suffering, either for animals or for the environment, in order to be truly vegan.

"I would argue there is no purity of motive in taking a vegan meal, because the taste of meat made you ill, but there would be purity of motive in doing it for the earth and to abstain from violence… So it's not enough to do the right thing, you've got to do it for the right reasons. Because otherwise you could do the right thing by accident couldn't you (laughs)… yeah so it's, it's a subtle distinction, but yeah it's, to be vegan it has to be for the moral purposes." (Mark, Cardiff vegans; vegan diet*)*

This is supported by other qualitative research, which has found that participants who had eliminated meat from their diet for ethical reasons were critical of those who had eliminated meat from their diet for health-related reasons (Fox & Ward, 2008b). In the current study, some participants also criticised consumers who followed a vegan diet but were thought to contribute to animal suffering in other ways, for example by supporting unethical businesses.

*"I boycott like McDonalds, Burger king, all of those things, but you will still have some vegans like, actively go into McDonalds, Burger King, those sorts of things, they won't like, even if they're just buying like chips or something like that, but I see that as like fundamentally like contradictory, because your meant to be a vegan and you're meant to reduce unnecessary suffering for the planet and to animals yet you're giving your money to one of the most nefarious corporations to ever exist in the history of the human race in terms of what McDonalds …" (*Chris, Cardiff vegans; vegetarian diet*)*

4.3.3 Awareness of the negative environmental impact of meat

Concern for the environment was much more prominent among meat-free participants compared to meat-eating participants. Many meat-free participants were concerned with environmental issues and tried to limit their environmental footprint through their food choices. Participants tried to buy local, unpackaged and organic produce. Participants also tried to eat seasonal produce, and many tried to avoid products containing palm oil.

"I try to buy vegetables in season, if fruits and vegetables are a bit more in season, otherwise I'll certainly buy British or local, over something further away … my little phrase is, 'don't burn the planet for your dinner'." (Isabella, Veganuary; vegan diet)

Many participants also discussed the negative environmental impacts associated with meat and dairy consumption, without being prompted. Meat-free participants associated meat and dairy consumption with issues such as greenhouse gas emissions, water use, land use, and de-forestation.

"I've now realised that the environmental impact of eating meat and, and fish as well, that it's just not really sustainable. I think there's really not very nice to think that over 50% of greenhouse gases are produced by the agricultural market or whatever. But basically it's just not very good for the environment and a lot of the trees are being cut down to make way for cattle and things in poorer countries when they could use that land to grow fruit and veg on, also I know that like beef in particular, well cows in particular, take a lot of the water up and I feel that, if there is a water crisis in some places I know there is one in Africa at the moment isn't there in East, or there's a famine, that, the water that we have shouldn't be going to something that then we're gonna kill and then, I don't know that's just my personal opinion, that it could be going to humans who need it." (Angela, Cardiff vegans; *vegetarian diet*)

Participants also commented on issues with global food security, associated with the production of meat and dairy. Participants felt that it was inefficient to grow crops to use as feed for animals, instead of growing crops directly for human consumption. One participant stated that global food security was in fact the main motivating factor for her to eliminate meat from her diet.

"*I was a teenager it was, a time of live-aid, and famine in Africa and it just as a teenager it was like well if we ate a vegetarian diet, then everybody would have enough food, just that very simplistic notion of having enough food for everyone to eat, made me, question eating meat and led me on to vegetarianism, it wasn't anything to do with animal welfare to be honest, but the transition to veganism was the opposite*." (Amelia, Veganuary; vegan diet)

Other participants mentioned global food security as a factor supporting their decision to be vegan or vegetarian.

"*It's sort of been quite a long journey I suppose cos first of all it was always morality, always morality, but now the planet is in such disarray and were all kind of putting our heads in the sand about it and it's quite terrifying to me*, *so it's sort of very much developed into environmental, sustainability sort of.. Yeah, it's the fact that were, people in the world are still dying in hunger when we literally have enough food to feed everybody, and beef isn't a very sustainable food choice really, so it kind of doesn't make any logical sense to me."* (Anna, Cardiff vegans; vegan diet)

Unlike meat-eating participants, some meat-free participants also directly linked meat and dairy consumption with climate change. These participants viewed meat and dairy production as contributing to climate change and also viewed following a meat-free diet as a way of mitigating this.

"*… I think our attitudes toward the environment underpins the situation we're currently in with climate change and if we're going to change that attitude, we need to embrace veganism on a larger scale*." (Chris, Cardiff vegans*;* vegetarian diet)

Awareness of the negative environmental impacts of meat also lead some participants to adopt a meat-free diet.

"I just think it's like ethically the right thing to do, to not eat meat or fish and yeah when I started to think more about it I also felt like, its ethically wrong to eat dairy products because the animals are exploited and suffer quite a lot, and I don't want to support that because, yeah I just really like animals and, yeah it's also bad for the environment, because of like, my carbon footprint would be much bigger if I wasn't vegan or vegetarian so, it's, yeah basically those two reasons like for the sake of the animals and also for the sake of the environment." (Catherine, people and planet; vegan diet)

"I think that's [the environment] one of the main reasons that I went vegetarian." (Angela, Cardiff vegans; vegetarian diet)

While some participants eliminated meat from their diet for environmental reasons, most became informed about the environmental consequences of meat consumption only after they had already adopted a vegan or vegetarian diet, for other reasons. Participants became aware of the environmental impact of meat and dairy after talking to other vegetarians and/or vegans, and after watching documentaries.

"*I became aware of the environmental impacts of it [meat consumption] about 5 years ago so I was 16, I was just doing some reading into it and I think I must have been looking up recipes and I found some other stuff about how bad it was for the environment then there's, one of my friends watched 'cowspiracy' and he was like a real big meat-eater before like he didn't really ever understand why I was vegetarian, and he watched this and he was then telling me about all the environmental impacts so, it took quite a few years for me to kind of realise the environmental impact as well as health and the, the moral impact*." (Angela, Cardiff vegans; vegetarian diet)

Many participants commented that although environmental reasons did not initially drive their decision to be vegetarian or vegan, that this was now one of the main factors reinforcing their decision to maintain a meat-free diet. This is in line with existing literature demonstrating that people's motivations for avoiding meat are not static and can be modified over time (Beardsworth & Keil, 1992). In this case, many participants had eliminated meat from their diet for reasons relating to animal welfare, before becoming more aware and concerned with the environmental issues associated with meat and dairy consumption.

"*I think the main reason why I actually became vegetarian was because I didn't feel like it was morally right or necessary to kill another kind of like live being for your benefit really… so there's that and, yeah things like 'cowspiracy' like I watched part of it and thought it was terrible … and I've now realised that the environmental impact of eating meat and fish as well, that it's just not really sustainable*." (Angela, Cardiff vegans; vegetarian diet).

"Y*eah I chose to be a vegetarian because I thought it was wrong to kill animals if you don't really need to, cos it's in general wrong to kill (laughs) and then I realised, well I got more aware of the environment and, you always know about stuff, I mean everyone knows about climate change but at some point I realised we, that I should try to contribute less to it, so that was when I decided to be vegan."* (Emma, people and planet; vegan diet)

4.3.4 Perceived responsibility

Participants who adopted a meat-free diet were also asked who they thought was responsible for limiting the negative environmental impact associated with food production and consumption. In contrast to the meat-eating participants, almost all of the meat-free participants felt that this was the responsibility of the consumer. Participants felt that consumers should try to buy products that are environmentally sustainable and avoid buying products that are environmentally damaging.

"I don't know, I think for quite a big part it's actually up to ourselves to take responsibility and not buy those kinds of food which are obviously damaging." (Catherine, people and planet; vegan diet)

Participants felt that consumers had the power to increase the supply of environmentally sustainable produce and to reduce the supply of unsustainable produce, as a result of their purchasing decisions. Participants supported this with evidence, as many participants described an increased availability of vegetarian/vegan products in supermarkets, in addition to increased sales of vegetarian/vegan foods, and decreased sales of dairy and meat.

"*I think obviously the way that capitalism works is all supply and demand so it, it's us as consumers who have the main responsibility and if we start buying things that aren't produced that way, then they'll start producing more things that are produced in a sustainable way, yeah apparently, vegan food is, was there like a 200% increase in vegan foods this year, vegan food sales, which is causing more foods to be made in that way, which is obviously going to have a knock on effect, I think dairy sales, dairy sales are down recently as well, which is cool, so hopefully if, the supply goes, then the demand will go, so*." (Anna, Cardiff vegans; vegan diet)

However, like meat-eating participants, some meat-free participants also noted that the purchasing decisions of the consumer are ultimately limited by the food that is available to buy. Thus, participants felt that consumer choices are ultimately governed by the food industry as a whole.

"I think, the buck ultimately stops with me as a person and what I do, but my power to do that, can, is restricted by what the food industries do with the food …." (Charlotte, Veganuary; vegan diet).

Some participants commented that supermarkets could stock more meat-free options, to increase the range of meat alternatives available to consumers.

Participants used examples of supermarkets that had recently introduced more vegan products as evidence that this could be done.

"*And also, the supermarkets themselves can do quite a lot of things by, for example Sainsbury's at the moment is like, offering more vegan products and tries to advertise for it a little bit, so, if chains can also do their part I guess.*" (Catherine, people and planet; vegan diet)

Many participants also felt that more could be done by the government and by environmental agencies, to reduce the negative environmental impacts associated with food production.

"*I think there's a lot to be said for like food policy, like, I don't think it should be down to the individual, I think that, like an individual, individual choices and consumption, like do help, but um I think it would be a lot more effective in the long run if there was like policy in place at a national level to make sure that food isn't environmentally damaging*." (Thomas, people and planet; vegan diet)

Like the meat-eating participants, meat-free participants believed that more policies could be introduced, to promote sustainable food choices, to limit packaging and pesticide use, and to subsidise environmentally friendly food choices.

"*I guess, partly the government and partly the people that produce it … there's probably so many things, using less packaging there's, there's like a, there's definitely an over packaging thing with some food. I don't know, the government could put more restrictions on things, so it forces you know people that, could use and supply different food to be more green, [and] better for the environment."* (Kim, Veganuary; vegan diet)

However, participants felt that this would be an '*ideal*' solution and that in the current absence of these policies, more needs to be done at a consumer level.

"I think in an ideal world we would look at our government but I think maybe in reality we've all got an individual responsibility for it, we have an individual responsibility for what we put in our mouths and what we buy. I don't think we can always blame other people for it, so I would say ideally the government because they should have rules and regulations against, things that are quite bad for the environment but I don't know, I mean you have people in the American government that are saying climate change isn't happening, so I think we all have an individual responsibility really." (Angela, Cardiff vegans; vegetarian diet)

4.3.5 Perceived impact of diet

In contrast to meat-eating participants, meat-free participants felt that reducing meat and/or animal products from ones' diet would have a significant positive impact on the environment. Many participants commented that their diet had a much lower environmental impact than diets which include meat. Participants stated that they had saved trees and water, and had reduced greenhouse gas emissions, as a result of not eating meat or other animal products.

"I know it's sort of a drop in the ocean but I found when I was researching that, the greenhouse gas footprint of a vegetarian, a vegan is something like 10, 10x lower than that of a meat eater, so with that, with all of that being said knowing the amount of water that I'd saved, by not feeding demand to animal agriculture the amount of rainforest that I've potentially saved, greenhouse gas emissions that I potentially save in terms of co2 and methane, and as someone who did sustainability planning and environmental policy at university, I felt well, if it's not going to be me, well who is it going to be?" (Chris, Cardiff vegans*; vegetarian diet*).

Meat-free participants commented that although the unique impact of one individual may be small, together vegans and vegetarians make a significant positive difference to the environment and to society as a whole. This contrasts with the meat-eating participants, who felt that there would be little point in reducing their personal meat consumption, as they felt this would have little impact on the environment.

"I think obviously, I appreciate that one person alone doesn't make a massive impact but I think that as a whole I think vegetarians can make quite a big difference to the environment." (Angela, Cardiff vegans; vegetarian diet)

Participants described recent increases in the availability of meat-free products and the decline of meat and dairy sales as evidence of the impact that vegans and vegetarians were having on society.

"Fundamentally, although I'm one person, if enough people reduces the demand for meat and you can see it with the dairy industry right now, they're criticising the, 'go vegan', because they're advertising on taxis and doing billboards, they also did a spread in the telegraph and it's leading to the decline of dairy, and that just proves how powerful direct action and boycotting can be, if everybody puts their mind to it and moves forward in the same direction so, yeah, those, those, those, are the main reasons I'd say why I've decided to pursue vegetarianism and eventually veganism I suppose." (Chris, Cardiff vegans; vegetarian diet)

4.3.6 Other factors associated with the transition to a meat-free diet

In addition to the motives discussed in the previous sections, the interviews with the meat-free participants revealed other factors which appeared to facilitate the transition to a meat-free diet and with the transition from a vegetarian to vegan diet.

4.3.6.1 Someone else went vegan

Knowing someone else who had recently become vegan appeared to be influential in encouraging participants' decision to become vegan themselves. For example, one participant recalled that seeing someone else become vegan made him '*get a grip'*, motivating him to also become vegan.

"*It was only really when my housemate, he decided to turn vegan, and he didn't have like, any sort of like educational background in relation to the environment, the planet and stuff, and I was like oh my god he's being a vegan, I was like he's going vegan and I'm still here eating meat like ok I don't eat beef and stuff but I was like God like, I need to get a grip sort of thing like I need to just do this now, and stop ignoring it … yeah when my housemate changed I was like right that's it, there's no more going back anymore, you can't hide from this anymore*" (Chris, Cardiff vegans*; vegetarian diet*).

Participants appeared to rationalize that if a person could go from eating meat to no animal products at all, then they as a vegetarian themselves, should also be able to make this transition.

"*I found it really difficult, I would often give up milk and cheese for a couple of weeks and I'd be quite emotional, id end up sort of going back to it, it was almost as if I was addicted to cheese, and yeah but then my friend who was eating meat decided that she was gonna go vegan, and it sounds really stupid, but I didn't want her to like beat me, so I managed to go vegan before she did (laughs) … but it was something that I had been trying to do for a really long time … I just couldn't deal with like the humiliation of someone who was eating meat going vegan before I did, it made me feel like quite weak, weak willed, so, yeah I wanted to beat her basically, so I went vegan before she did*" (Anna, Cardiff vegans; vegan diet)

Another participant commented that she had wanted to become vegan for a while, but had finally decided to try it after her daughter had decided to become vegan. The participant wanted to ensure that her daughter would get enough nutrients in her diet and felt that becoming vegan herself would aid her in this.

"*My youngest daughter who's also vegan, I'm always thinking, cos if she's cooking for herself it won't be nutritious at all it will just be, whatever she can cook easily, she won't really put much thought into the nutrition side of it … I thought, I was* *more worried about well what's she gonna eat … if I'm not there to sort of think about it more and I think being vegetarian was very easy and very lazy from the nutrition side of it, so I think more about her than I do about me with nutrition*." (Zoe, Veganuary; vegan diet)

Some participants also recalled becoming vegan after their spouse had made the same decision.

"*My husband who, we've been together just under 10 years, he has always been veggie as well since a very young age, he's done veganism as well … he's gone vegan again last summer and I did 'Veganuary' as a sort of, 'oh let's try it, see what happens' kind of thing and loved it."* (Isabella, Veganuary; vegan diet)

4.3.6.2 Transitional life moments

Some of the meat-free participants had become vegan after a significant life transition such as moving to a new house and/or to a new job. For example, one participant felt that it was easier to start new job with the new identity of being a vegan, rather than having to change her identity around other people who had known her previously to be a meat-eater.

"*…by that point I'd started my job in Glasgow, so, by default, the person I was when I arrived there was a vegan, so, it's not like it is, so, down here when I go out with my mate Ken it's like, 'oh god can you not have fish' , whereas there's , nothing like that happens in Glasgow cos it's like, nobody would think to ask me, if I wanted fish, or, or whatever, so it's almost like I've, I've arrived with this new identity that's made it easier to keep it up in a way*" (Charlotte, Veganuary; vegan diet)

Similar to the findings from the interviews with meat-eating participants, many meat-free participants described how they had found it difficult trying to follow a vegan or vegetarian diet whilst living at home with meat-eating parents. This was particularly difficult where participants were not involved in the household cooking, and where participants' parents did not understand the concept of a vegan or vegetarian diet.

"It was slightly awkward before, I was living with my parents and somehow having to get this vegetarian food at, at home, which wasn't always understood that well so that wasn't, wasn't a smooth transition really... they'd [participants' parents] make, a sort of quiche and there'd be little bits of ham in it and they wouldn't seem to think that that was much of a problem for a vegetarian (laughs)" (Johnathan, Cardiff vegans; vegan diet)

As a result, some participants became vegetarian or vegan after moving away from home. One participant recalled that her family were unsupportive of her diet and would not prepare vegan meals for her. This participant commented that she became fully vegan once she was able to control her own finances and cooking, when she moved to university.

"*I tried to do it gradually at first and I found it really … I was still living at home and I had a dad and a sister who ate meat and were very jokey very unsupportive … I think when I moved to university I realized that I have control of my own money now my own budget, so in the summer holidays just building up to that I just went completely vegan … the more I stood my ground the more my family respected it and I think that was the turning point then when they started getting behind me when I thought no this is something that I'm going to carry on with now.*" (Lucy, Cardiff vegans; vegan diet)

Another participant similarly commented that it was difficult to be vegan whilst living at home where his parents were responsible for cooking. The participant felt that his parents did not really understand what a vegan diet was, explaining that they would find it difficult to cook vegan meals after having cooked with meat and other animal products for such a long time. The participant commented that it was easier to become vegan after moving to university whilst learning to cook for the first time.

"I went [vegan] when I started uni … so I like, went vegan just as I was learning to cook so, it was kinda easy just to make the transition ... like my mum and dad could never do it because they've been like cooking with animal products for like 40 years or something … my dad didn't really know what it was, he kept putting cheese on my thing and I was like I can't eat that (laughs), so … when I moved to uni was when I first started cooking for myself, so it was kinda like a clear break, it would have been more difficult if I'd been at home because I would have had to like, slowly do it, but when I moved to uni it was kinda like a blank slate which I could just start doing it from. " (Thomas, people and planet; vegan diet)

In these cases, transitional moments, specifically moving to a new home, a new city, or starting a new job, allowed participants to adopt a vegan diet with a clean slate, a new identity, and a greater sense of control.

4.2.6.3 A vegan trial period

Some meat-free participants transitioned to being vegan after trialling a vegan diet for one month (in January) as part of a campaign called 'Veganuary'. Participants enjoyed the fact that the campaign allowed them to trial veganism for a set time period, without feeling committed to following a vegan diet afterwards, for example if they had found following a vegan diet to be too challenging.

"*The thing that really sold it to me was the fact that it's a set period so if I didn't like it, or did have a problem, that I could keep my vegetarian diet afterwards*." (Isabella, Veganuary; vegan diet)

Some participants felt that the set time period of Veganuary helped them to gradually ease other people into their change of diet and identity.

"*The fact that it was a defined period and it would be easy to say that, I'm just doing it for January, both to kind of ease my way into telling all my friends I'm going* *vegan … so Veganuary was much, kind of, easier foot in the door than kind of coming out with a 'and you're all gonna have to buy Soya milk for the rest of your lives*" (Isabella, Veganuary; vegan diet)

Participants also appreciated the fact that Veganuary allowed them to trial veganism alongside a number of other people, at the same time. Participants praised the amount of social support they received within the online Veganuary community and felt that this helped to create a positive and supportive environment to trial being vegan.

"*Well the Facebook group has been absolutely great, because it's 70-odd thousand people doing it and, I think there's about 15,000 on there now on the group, and you do make friends, everyone is in the same boat trying out this that the other and for the first time and having different experiences and kind of just the way that people within the group have supported each other, and discovered all these glorious things together has been, great and the admins and, the whole way it's run and set up, to eliminate, any sort of unnecessary unpleasantness has been really really good, I think they're an excellent organisation, the way they have managed any discord they've had as well has been brilliant*." (Isabella, Veganuary; vegan diet)

Thus, being able to trial being vegan appeared to be effective in encouraging dietary change among participants, with long lasting effects, while social support from others appeared to facilitate this transition.

4.3.7 Social stigma associated with meat reduction

Although meat-free participants viewed their diet and lifestyle positively, many noted that there were also some difficulties associated with following a meat-free diet. Specifically, many meat-free participants felt that there was social stigma surrounding vegetarianism and veganism. Participants felt that veganism in particular is associated with negative stereotypes, namely the view that vegans are extremist and force their opinions onto other people.

"The media I would say are very, very anti-vegan, they do have a bias against vegans, they do like to promote the stereotype of vegans as, you know people who are very frail, very weak, um, or extremists, things like that which don't help entice people to the vegan community. There are so many stereotypes about vegans and it's completely unfounded, like if I'm the one who's not partaking in the unnecessary suffering of animals and actively trying to reduce greenhouse gas impacts on the planet why am I considered an extremist compared to someone who actually partakes in these processes?" (Chris, Cardiff vegans; vegetarian diet)

Many participants actively tried to distance themselves from this perception. Some participants felt that leading by example would be a more effective way of spreading the vegan cause.

"…I really don't like that preachy vegan thing … that's not something I want to put out into the world so, I prefer to sort of tread softly and show by example, rather than, rather than preaching about it …" (Isabella, Veganuary; vegan diet)

By deciding not to consume meat or other animal products, vegans and vegetarians challenge current cultural conventions and social norms surrounding the appropriateness of eating meat. This appears to be a source of tension between meat-eaters and those who actively decide not to consume animal products, as many meat-free participants recalled feeling socially isolated as a result of their diet. One participant described feeling marginalised as she felt her vegan diet acted as a barrier to cultural celebrations surrounding food. This reflects some of the findings from the interviews with meat-eating participants, which demonstrated how meat consumption is so normalised and embedded within different social practices and occasions.

"I also feel quite excluded from you know with things like birthdays when everyone's having like a piece of cake and I just can't participate ... It is quite difficult, especially stuff like, we have quite a lot of holidays around food, so like Easter is coming up, and um all of the ladies in work brought each other Easter eggs, and they all

brought me Easter eggs as well but they were all dairy so I couldn't eat any of them, so I had to give them to my boyfriend and Its just quite sad I can't participate in stuff like that now, yeah I definitely get quite excluded…"(Anna, Cardiff vegans; vegan diet)

Participants also discussed how meat-eaters often commented or joked about veganism. Participants indicated that these kinds of jokes are inappropriate, emphasising that deciding to be vegan is a personal and moral decision.

"I mean there is very to a lot of hostility towards vegans, definitely, … I had, I had one incident when a well-meaning but slightly silly friend stuck a meme on my [Facebook] page, I asked them to take it down because although it didn't offend me I don't, I didn't want it there because I don't think it should be a joke if that makes sense … like you wouldn't take the piss out of someone's religious beliefs so I don't think you should take the piss out something moral that isn't religious if that makes sense." (Isabella, Veganuary; vegan diet)

Participants drew parallels with the inappropriateness of mocking someone's religious beliefs in support of this.

"What I find is the most difficult is the amount of social exclusion I get, so I often get sort of coined as 'the vegan' in work … you know, if I was um, Jewish, can you imagine if someone called me like 'the Jew of the office', like it's quite embarrassing ... It's kind of 'othering' me, do you know what I mean, like kind of like in-group and out-group, um I feel like I'm in some sort of outsider group, almost like a zoo animal to be looked at." (Anna, Cardiff vegans; vegan diet)

Another vegetarian participant discussed other intrusive forms of social exclusion, as he recalled his experience of being verbally and physically assaulted during a vegan protest. He felt that this kind of social exclusion occurred as a result of an implicit confrontation as vegan and vegetarian individuals challenge perceptions that eating meat is acceptable.

"When I do protest you do get a lot of stick from people who are meat eaters, which I feel they are just insecure about the fact that their diet is causing unnecessary suffering to animals whilst our diet is spreading a lot more compassion and empathy ... sometimes yeah you can feel so ostracised, to the point that it's literally just you in this world, because you say you have a protest or something and you get some really ridiculous meat eaters who will throw meat at you or just insult you .. you can feel quite ostracized… vegetarians and vegans have actively put an ideological barrier in front of the majority of the population because for many people eating meat is acceptable, but we have suggested that it's not acceptable, so when we put that ideological drawbridge in front of people you do feel, I would say, I would say you do feel more marginalized." (Chris, Cardiff vegans; vegetarian diet)

Although social stigma did not prevent participants from continuing to follow a meat-free diet, it did appear to lead to feelings of marginalisation. This again demonstrates how meat consumption is normalised within western culture, while consuming a meat-free diet is social marked (e.g. de Boer et al., 2017).

4.3.8 Section summary

In sum, concern for animal welfare appeared to be the main motive encouraging meat-free participants to adopt a vegetarian or vegan diet, with health benefits and environmental concern also reinforcing this dietary decision. Meat-free participants were much more aware of the negative environmental impacts of meat and were more likely to view a reduced meat diet as having positive environmental impact, including mitigating rising greenhouse gas emissions, compared to meat-eating participants. The interviews further supported the role of social norms in driving meat consumption and acting as a barrier to meat reduction.

4.4 Chapter summary and implications for study 2

4.4.1 General summary

This chapter reports on the findings from the initial qualitative study conducted for this thesis, which aimed to investigate the motives driving meat consumption and meat reduction, as well as awareness of the negative environmental impacts of meat, among participants who included and excluded meat form their diet. This section will briefly summarise the main results in relation to this aim.

The main factors motivating meat consumption appeared to be taste and concern for health. However, eating meat also appeared to be an unquestioned dietary habit for many participants, ingrained from a young age. This appeared to be reinforced by social norms presenting meat consumption as a normal and natural behaviour, especially in households where other people regularly consumed meat. This also acted as a barrier to meat reduction, as both meat-eating and meat-free participants described difficulties trying to reduce their meat consumption whilst being surrounded by others, particularly within the same household, who regularly consumed meat. The interviews with meat-free participants further revealed how deciding not to eat meat appeared to violate social norms relating to meat consumption, leading participants to feel marginalised.

Meat-eating participants were the most willing to reduce their meat consumption for reasons relating to health, and some participants had already reduced their red meat consumption for this reason. These participants were less willing to reduce their meat consumption for reasons relating to animal welfare or the environment, as these issues were less salient to participants. On the other hand, concern for animal welfare was the main motive for meat reduction among meat-free participants, with health concerns playing a small role in reinforcing this decision. This apparent discrepancy is supported by previous literature evidencing different motivations for eating less meat across different consumer groups. For example concern for animal welfare and environmental concerns have been found to be stronger motivators for those already reducing their meat consumption compared to regular meat-eaters, who tend to be more motivated by health and cost (de Boer et al., 2017; Lentz et al., 2018). This suggests that strategies aimed at meat reduction among meat-eaters would benefit from focussing on the negative health impacts of meat, while focussing on animal welfare is not likely to be as effective.

Although meat-eating participants had some awareness that eating meat was bad for the environment, participants did not tend to associate meat consumption with climate change and many stated that they would need more evidence to convince them of this link. Following this, meat-eating participants did not perceive that eating less meat would have much of a positive impact on the environment. In contrast, meat-free participants appeared to be more aware of the link between meat consumption and climate change and were much more likely to view eating a meat-free diet as having a positive impact on the environment. However, most meat-free participants only became aware of the negative environmental impacts of meat after they had already adopted a meat-free diet for other reasons, namely animal welfare.

4.4.2 Contributions to the literature

This study provides an important contribution to the literature which has tended to focus on the motives of vegetarians, without investigating what factors might encourage regular meat-eaters to reduce their meat consumption (Harguess et al., 2020; Zur & Klöckner, 2014). By comparing the experiences of participants who regularly consume meat to those who exclude meat from their diet, this study provides unique insight into the different motivations towards reduced meat consumption. For example, the results showed that meat-eating participants were the most willing to reduce their meat consumption to benefit their health, while animal welfare was the main motivation among meat-free participants. This supports evidence from past quantitative research which has demonstrated similar differences in the motivations for meat reduction among individuals with different diets (De Backer & Hudders, 2014; de Boer et al., 2017; Lentz, et al., 2018). These findings highlight the need for research aimed at meat reduction to shift away from focusing on the motivations of vegetarians. Future research should instead focus on the motives that would encourage individuals who regularly consume meat to reduce their consumption, given that this would be the target consumer group for strategies aimed at meat reduction. Moreover, the findings have important implications with regards to interventions aimed at meat reduction. Specifically, the findings suggest that, although animal welfare is an important motivation for those following a vegetarian diet, focussing on the health impacts of meat might be more effective in encouraging regular consumers of meat to reduce their consumption.

Additionally, this study provides unique insight into differences in awareness of the negative environmental impacts of meat across participants with different diets. Meat-free participants were much more aware of the negative environmental impacts of meat and were also more likely to perceive a reduced meat diet as helping to protect the environment, compared to meat-eating participants. These findings support past literature which has shown that awareness of the negative environmental impacts of meat and the perceived impact of a reduced meat diet on mitigating global warming, is associated with an increased willingness to reduce one's meat consumption (de Boer et al., 2016; Truelove & Parks, 2012). On the other hand, the present findings suggest that a reduced meat diet might actually precede an increased awareness of the environmental impacts of meat, with this knowledge acting as a further reinforcement for a meat-free diet. This suggests that the previously identified relationship between awareness and behaviour change in relation to meat reduction is not linear, as individuals might become more aware of environmental issues only after reducing their meat consumption. This means that interventions aimed at encouraging reduced meat consumption might also have the potential to increase environmental awareness and concern. This is an important finding, given that an increased environmental concern can act as a driver for additional pro-environmental behaviours (e.g. Carrico et al., 2018).

4.4.3 Implications for study 2

Some of the findings presented in this chapter were used alongside existing literature (as reviewed in chapters 1 and 2) to inform the development of the second quantitative study presented in this thesis. First, the results highlighted the role of different psychosocial factors, such as attitudes and in particular social norms, in motivating meat consumption as well as acting as a potential barrier to meat reduction. This supports psychological models of behaviour change which focus on the role of different psychosocial factors in driving behaviour change, including reducing one's meat consumption (see chapter 2, section 2.3). Following from this, the second study presented in this thesis uses behaviour change models, the TPB and TTM (Ajzen, 1991; Prochaska & Velicer, 1997) to further investigate how different psychosocial factors might be associated with a persons' willingness to reduce their red and processed meat consumption.

Second, the results showed that meat-eating participants were largely unaware of the negative environmental impacts of meat, highlighting the need to raise awareness for this issue. On the other hand, it was also found that meat-eating participants were the most willing to reduce their meat-consumption for health rather than environmental reasons. Following from this, as well as past literature demonstrating the varying effectiveness of different informational strategies aimed at meat reduction (see chapter 2 section 2.4), a randomised messaging intervention was developed to compare the effectiveness of information highlighting the environmental and/or health impacts of meat on encouraging participants to reduce their red and processed meat consumption. Furthermore, the interviews with meat-eating participants also showed some evidence for the use of white meat and fish as replacements for red meat. This adds to past literature and supports the exploration of these foods as potential replacements for red and processed meat during the randomised messaging intervention.

Third, the results showed that meat-free participants became more aware and concerned with environmental issues after reducing their meat consumption, even if they had reduced their meat consumption for reasons not related to the environment. This is in line with past literature also demonstrating that performing a pro-environmental behaviour, including meat reduction, can lead to an uptake of other pro-environmental behaviours through different psychological mechanisms including increased environmental concern or pro-environmental identity (see chapter 2 section 2.5). Based on this, the second study presented in this thesis also aimed to investigate whether a reduced consumption of meat might be associated with an increased willingness to perform additional pro-environmental behaviours.

Finally, the interviews showed that taking part in a short-term campaign to reduce ones' meat consumption (i.e. Veganuary) can act as a 'foot-in-the-door' to long-lasting dietary change. This supports recent evidence that short-term interventions aimed at meat reduction can have long lasting effects (see chapter 2 section 2.4). Thus, the second study presented also aimed to investigate whether participants who reduced their meat consumption during the randomised messaging intervention would continue to do reduce their consumption after the intervention had ended, at a one-month follow-up.

Chapter 5: Drawing on Behaviour Change Models to Investigate Participants' Willingness to Reduce Red and Processed Meat

5.1 Introduction

This chapter further addresses the first aim of this thesis (see chapter 2 section 2.6) by drawing on behaviour change models, the Theory of Planned Behaviour (TPB; Ajzen, 1991) and the Transtheoretical Model (TTM; Prochaska & Velicer, 1997), to investigate participants' willingness to reduce their red and processed meat consumption. This is done using baseline data collected as part of the second, quantitative, study in this thesis (see chapter 3, section 3.6.2). First, the TTM is used to investigate participants' readiness to reduce their red and processed meat consumption, by assessing the distribution of participants across the different stages of change: precontemplation, contemplation, preparation and action. In line with the TTM, socio-cognitive components associated with stage progression, decisional balance and self-efficacy, are also assessed across the different stages of change. Second, the TPB is used to predict intentions to reduce red and processed meat, as a function of attitudes, subjective norms, descriptive norms and perceived behavioural control. Health identity, pro-environmental identity, and meat-eater identity are also included within the TPB, to explain additional variance in intentions to reduce red and processed meat. Third, differences in the TPB constructs across each of the stages of change are assessed, to investigate what psychosocial factors might be associated with an increased readiness to reduce red and processed meat. In doing so, this chapter aims to add to the previous chapter (4) which investigated the motives driving meat-reduction, by providing an understanding of how and when different psychosocial factors might encourage individuals to reduce their consumption of red and processed meat.

This chapter is largely exploratory, however certain expectations can be made by drawing on past literature, as reviewed in chapter 2 (see section 2.3). In relation to the TTM, it was first expected that most participants would not have yet considered reducing their red and processed meat consumption and would therefore fall into earlier stages of change, namely the precontemplation stage. This is because similar previous studies have shown a tendency for individuals to fall into earlier stages of change when investigating participants' readiness to adopt a plant-based diet (e.g. Lea, et al., 2006), and considering that individuals are often unwilling to reduce their meat consumption (e.g. Tobler et al., 2011). Second, in line with the TTM, it was expected that progression from precontemplation to action would be associated with increased perceived benefits and decreased perceived barriers (decisional balance) associated with eating less red and processed meat, where the perceived benefits would be higher and the perceived barriers would be lower in the later compared to earlier stages of change (see Noia & Prochaska, 2010). Third, it was expected that stage progression would be associated with higher self-efficacy, so that self-efficacy would be greater in the later compared to earlier stages of change (e.g. see Herrick, Stone & Mettler, 1997).

In relation to the TPB, it was thought that participants' intentions to eat less red and processed meat would be predicted by attitudes, subjective norms, descriptive norms and perceived behavioural control (Ajzen, 1991). However, it was not known whether any additional variance in participants' intentions would be explained by health, pro-environmental or meat-eater identity, given that few studies have explored the role of identity in predicting intentions to eat less meat, while the existing literature has yielded mixed results (e.g. Carfora et al., 2017b; Povey, et al., 2001).

In relation to the combined TTM/TPB model, it was not known how the TPB variables would differ across the different stages of change, as few studies have applied combined TTM/TPB models to understand meat reduction. However, previous literature has indicated a general increase in TPB constructs (e.g. more positive attitudes, higher perceived behavioural control) in later compared to earlier stages of change with regards to adopting a plant-based diet (e.g. Wyker & Davidson, 2010). Thus, a similar pattern could be expected with regards to reducing red and processed meat, as investigated in this chapter.

This next section in this chapter (section 5.2) reports on the results from the baseline data to address the above research aims. First, participants' readiness to reduce their red and processed meat consumption as indicated by the stages of change within the TTM is reported, followed by participants' self-efficacy and perceived benefits and barriers (decisional balance) across the different stages (section 5.2.1). Next, participants' intentions to reduce their red and processed meat consumption as predicted by the TPB and identity variables will be reported (section 5.2.2). Differences in the TPB variables across each stage of change will then be reported as part of a combined TTM/TPB model (section 5.2.3). The final section of this chapter will provide a brief summary and conclusion, including the novel contributions offered by this study (section 5.3).

5.2 Results

5.2.1 The Transtheoretical model

5.2.1.1 Stages of change

Stage of change was assessed using a single measure, where participants were asked to select one statement that best represented their readiness to reduce their red and processed meat consumption (see chapter 3, section 3.6.2). Thus, participants could belong to only one from four possible stages: precontemplation, contemplation, preparation and action. The results showed that the majority of participants were in the precontemplation stage, followed by the preparation stage, with almost an equal number of participants falling into the contemplation and action stages; 41% (n = 131) of participants were in the precontemplation stage, 15% of participants (n = 49) were in the contemplation stage, 29% (n = 92) were in the preparation stage, and 15% (n = 48) were in the action stage. This means that most participants had not even considered reducing their red and processed meat intake. On the other hand, many participants were preparing to reduce their red and processed meat intake in the near future, while a smaller number of participants had considered reducing their red and processed meat intake but had not made any attempt to do so, or had already taken action to reduce their red and processed meat intake.

5.2.1.2 Demographic differences across stages of change

Participant demographics across the different stages of change are summarised in Table 2. As shown by Table 2, there appeared to be little variation across the different stages. Following from this, Chi-square analysis showed that there was no significant association between gender ($x^2 = 2.34$, p = 0.509), age (x^2 = 7.76, p = 0.242) or level of study (x^2 = 3.43, p = 0.331) and stage of change. Thus, there were not any significant demographic differences between participants in each of the different stages of change.

Table 2. Participant demographics across the stages of change

	Precontemplation (n = 131)	Contemplation (n = 49)	Preparation (n = 92)	Action (n = 48)	Total (n)
Gender					
Male	n = 29 (22%)	n = 7 (14%)	n = 14 (15%)	n = 9 (19%)	n = 59 (18%)
Female	n = 101 (78%)	n = 42 (86%)	n = 78 (85%)	n = 39 (81%)	n = 260 (82%)
Age					
18-20	n = 105 (80%)	n = 39 (80%)	n = 69 (75%)	n = 31 (65%)	n = 244 (76%)
21-24	n = 19 (15%)	n = 9 (18%)	n = 19 (21%)	n = 11 (23%)	n = 58 (18%)
25+	n = 7 (5%)	n = 1 (2%)	n = 4 (4%)	n = 6 (13%)	n = 18 (6%)
Level of study					
Undergraduate	n = 119 (91%)	n = 48 (98%)	n =83 (90%)	n =43 (90%)	n = 293 (92%)
Postgraduate	n = 12 (9%)	n = 1 (2%)	n = 9 (10%)	n =5 (10%)	n = 27 (8%)

5.2.1.3 Meat consumption across stages of change

The average number of portions of red and processed meat consumed by participants in each stage of change is summarised in Table 3. As shown by Table 3, both red and processed meat consumption was higher in the earlier stages of change, e.g. precontemplation, contemplation, and preparation, as compared to the action stage. A one-way MANOVA was conducted to assess whether there were any significant differences in participants' red and processed meat consumption across each stage of change, with stage of change as the independent variable. Whether there was a significant difference in the amount of red and processed meat consumed was assessed separately and in combination, using three dependent variables: red meat, processed meat, and red and processed meat. The results showed that there were no significant differences in participants' consumption of red and/or processed meat across the different stages of change (Pillai's trace = 0.13 (F (6, 632) = 1.64, p = 0.134). This indicates that, although participants appeared to eat less red and processed meat in the action stage compared to the earlier stages of change, this apparent trend was not statistically significant.

Table 3. Meat consumption across each stage of change

	M	SD
Red and Processed Meat		
Precontemplation	7.50	3.59
Contemplation	7.57	3.68
preparation	7.42	3.13
Action	5.88	3.04
Red Meat		
Precontemplation	4.27	1.18
Contemplation	4.27	1.86
Preparation	4.34	1.71
Action	3.63	1.28
Processed Meat		
Precontemplation	3.23	2.24
Contemplation	3.31	2.37
Preparation	3.09	2.21
Action	2.25	2.28

5.2.1.4 Decisional balance across stages of change

Participants' agreement with items reflecting different benefits (pros) and barriers (cons) associated with reducing red and processed meat was measured as an indicator of decisional balance (see chapter 3, section 3.6.2). The average scores on the perceived benefits and barriers by participants in each stage of change are presented in Table 4. The Table shows that scores on the perceived benefits associated with reducing red and processed meat tended to cluster around the midpoint, and increased, though only slightly, from precontemplation to action. There appeared to be slightly more variation in participant scores on the perceived barriers associated with eating less red and processed meat, which also tended to cluster around the midpoint, but decreased from precontemplation to action. A

MANOVA was conducted to assess whether there was a significant difference in the perceived benefits and barriers associated with reducing less red and processed meat across the different stages of change. Stage of change was the independent variable and perceived benefits and barriers were the respective dependent variables. The results indicated a significant effect (Pillai's trace = 0.36 (F (6, 632) = 22.90, p < 0.001). Univariate ANOVAs with Tukey-HSD post-hoc comparisons were used to follow-up this effect and the results are summarised below, and in Table 4.

As shown by Table 4, the results revealed a significant difference between the perceived benefits associated with reducing red and processed meat across the stages of change (F (3, 316) = 7.35, p < 0.001). Post-hoc comparisons showed that participants in the contemplation and preparation stages had significantly higher scores than those in the precontemplation stage. However, there was no significant difference between the precontemplation and action stage, between the contemplation and preparation stage, or between the preparation and action stage. Thus, the results support that stage progression was associated with increased perceived benefits in relation to reducing red and processed meat, from the precontemplation stage to the contemplation and preparation stages.

As shown by Table 4, the results also revealed a significant difference between the perceived barriers towards reducing red and processed meat across the stages of change (F (3, 316) = 21.40, p = < 0.001). Post-hoc comparisons showed that participants in the preparation and action stages had significantly lower scores compared to those in the precontemplation and contemplation stages. There were no significant differences between the contemplation and precontemplation stage and there was no significant difference between the action and preparation stage. Thus, the results support that stage progression was associated with decreased perceived barriers associated with eating less red and processed meat, from precontemplation to preparation and action, and from contemplation to preparation and action.

In line with the methods used by Prochaska (1994), mean benefit and barrier scores were converted to standardised t-scores, with a mean of 50 and a standard deviation of 10, to estimate the maximum increase in the perceived benefits and maximum decrease in perceived barriers associated with eating less red and processed meat, from precontemplation to action (see chapter 2, section 2.3.1). Mean t-scores across each stage of change are summarised in Figure 5. In line with the TTM, the graph shows that the perceived barriers were higher than the perceived benefits in the earlier stages of change, with the scores crossing-over in the contemplation stage. Interestingly, the results showed a maximum increase in the perceived benefits of 5.56 T-points (0.56 SD) and a maximum decrease in the perceived barriers of 10.54 T-points (1.05 SD). Thus, the findings indicate that for reducing red and processed meat consumption, the perceived barriers decreased approximately twice as much as the perceived benefits increased, from precontemplation to action.

Table 4. Tukey's HSD post-hoc comparisons of perceived benefits and barriers across the stages of change

Perceived Benefits						
	Tukey's HSD post-hoc comparisons					
	Precontemplation	Contemplation	Preparation	Action	Mean	SD
Precontemplation	-				4.24	0.48
Contemplation	$p = 0.005^{**}$	-			4.52	0.46
Preparation	$p < 0.001^{**}$	$p = 1.00$	-		4.52	0.50
Action	$p = 0.249$	$p = 0.604$	$p = 0.465$	-	4.40	0.58
Perceived Barriers						
	Tukey's HSD post-hoc comparisons					
	Precontemplation	Contemplation	Preparation	Action	Mean	SD
Precontemplation	-				4.21	0.86
Contemplation	$p = 0.952$	-			4.13	0.76
Preparation	$p < 0.001^{**}$	$p = 0.001^{**}$	-		3.55	0.87
Action	$p < 0.001^{**}$	$p < 0.001^{**}$	$p = 0.117$	-	3.21	1.00

Note. * $p < 0.05$, ** $p < 0.01$

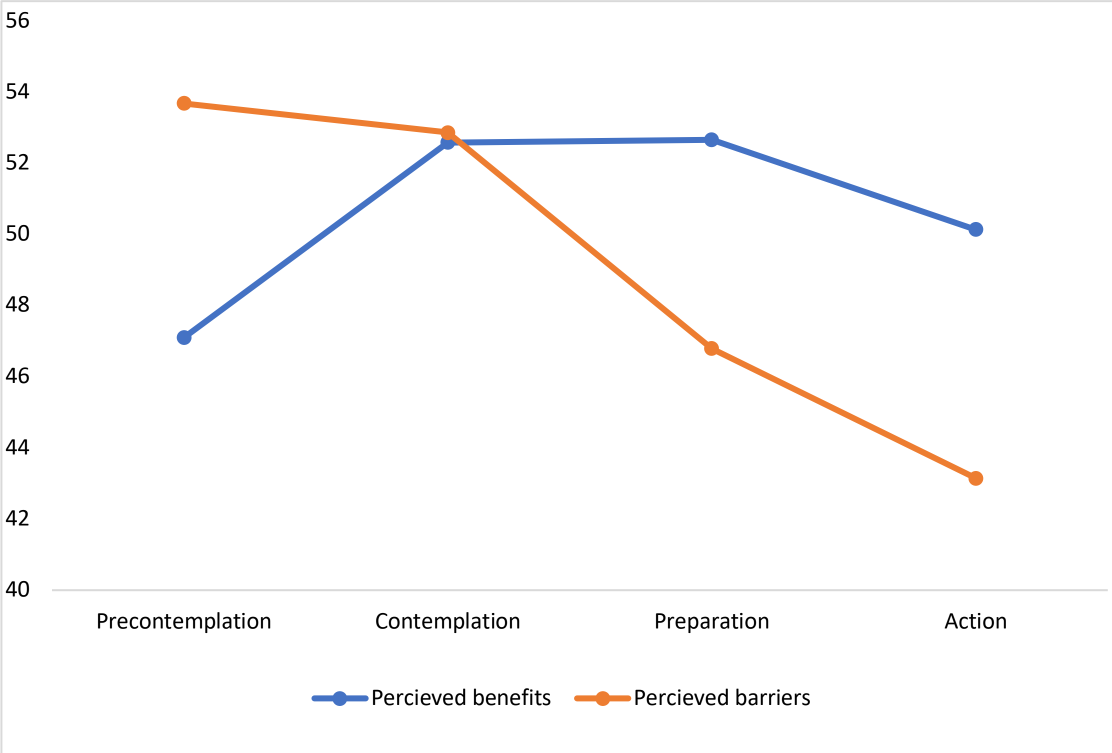

Figure 5. Mean t-scores for the perceived benefits and barriers associated with reducing red and processed meat.

5.2.1.5 Self-efficacy across stages of change

Participants' perceived ability to reduce their red and processed meat consumption was measured as an indicator of self-efficacy (see chapter 3, section 3.6.2). Average perceived self-efficacy for participants in each of the stages of change is summarised in Table 5. Observation of Table 5 indicates that self-efficacy was above the midpoint across the different stages, suggesting that overall, participants felt capable of reducing their red and processed meat consumption. The Table also shows that self-efficacy appeared to increase with stage progression, where it was higher in the later stages of change, preparation and action, compared to the earlier stages, precontemplation and contemplation. A One-way ANOVA was conducted to assess whether there was a significant difference in self-efficacy across the stages of change, with stage of change as the independent variable and self-efficacy as the dependent variable. The results indicated that there was a significant difference in self-efficacy across the different stages (F (3, 316) = 18.50, $p < 0.001$). Tukey-HSD post-hoc comparisons were used to follow up this effect. The results are summarised in Table 5. As shown by the Table, the results showed that participants in the contemplation stage had a significantly lower perceived self-efficacy than those in the precontemplation stage. On the other hand, participants in the preparation and action stages had a significantly higher perceived self-efficacy compared to those in the precontemplation stage. Participants in the preparation and action stages had a significantly higher self-efficacy than those in the contemplation stage. There was no significant difference between participants in the preparation and action stages. Thus, the results suggest that self-efficacy increased with stage progression, following an initial decrease in self-efficacy from precontemplation to contemplation. However self-efficacy did not significantly increase from preparation to action.

Table 5. Tukey's HSD comparisons of self-efficacy across the stages of change

	Precontemplation	Contemplation	Preparation	Action	Mean	SD
Precontemplation	-				4.91	1.24
Contemplation	$p = 0.003^{**}$	-			4.28	1.08
Preparation	$p = 0.015^{*}$	$p < 0.001^{**}$	-		5.35	0.89
Action	$p < 0.001^{**}$	$p < 0.001^{**}$	$p = 0.132$	-	5.77	0.95

Note. * $p < 0.05$, ** $p < 0.01$.

5.2.1.6 Section summary

Overall, these results show that most participants had not yet considered reducing their red and processed meat consumption. Some participants were contemplating or preparing to reduce their consumption, and others had already taken some action to reduce the amount of red and processed meat they consumed. An increased readiness to reduce ones' red and processed meat consumption was associated with more perceived benefits and importantly, fewer perceived barriers, towards doing so. Similarly, an increased readiness to reduce ones' red and processed meat consumption was associated with a higher perceived efficacy to do so. Though, the results also showed that an increased readiness to reduce ones' red and processed meat consumption was not necessarily associated with a significantly lower consumption of red and processed meat.

5.2.2 The Theory of Planned Behaviour

5.2.2.1 Relationship between TPB and identity variables

Participants' intentions, attitudes, perceived behavioural control, and subjective and descriptive norms in relation to reducing red and processed meat were measured in accordance with the TPB, as well as participants' pro-environmental, health and meat-eater identities (see chapter 2, sections 2.3.2 and 2.3.3; also see chapter 3, section 3.6.2). Pearson correlation analysis was conducted to assess the relationship between the TPB and identity variables. The means, standard deviations and intercorrelation between the TPB and identity variables are displayed in Table 6. Observation of Table 6 indicates that overall, participants viewed reducing their red and processed meat consumption positively and as being within their control, with high scores shown on the measures for attitudes and perceived behavioural control. Scores on the descriptive norm measure tended to cluster around the midpoint, suggesting that participants did not view eating less red and processed meat as being particularly common or uncommon. Subjective norm scores were slightly lower, suggesting that participants did not feel a strong social pressure from significant others to reduce their red and processed meat consumption. Scores on the intention measure also clustered around the midpoint, indicating that participants did not strongly intend to reduce their red and processed meat-intake, but were also not reluctant to do so. Scores on the health and pro-environmental identity measures were above the mid-point, while scores on the meat-eater identity measure were slightly higher. Thus, participants identified as being healthy and as being pro-environmental, but identified more strongly as being a meat-eater.

All variables were found to positively correlate with intentions to eat less red and processed meat, with the exception of meat-eater identity, which correlated negatively. Thus, strongly identifying as a meat-eater was associated with lower intentions to reduce one's red and processed meat consumption. Subjective norms correlated the most strongly with intentions, followed by attitudes. Thus, intentions to eat less red and processed meat were strongly associated with a strong perceived social pressure to reduce one's consumption, followed by positive attitudes towards doing so. Health identity and perceived behavioural control were the weakest correlates of intention. This suggests that identifying strongly as a health-conscious individual and having a high perceived control over one's red and processed meat consumption was not strongly associated with increased intentions to reduce one's red and processed meat consumption.

5.2.2.2 TPB and identity variables as predictors of intention

A linear hierarchical-multiple regression was computed to assess the ability of TPB (attitudes, perceived behavioural control, subjective norms and descriptive norms) and identity (health identity, pro-environmental identity and meat-eater identity) variables to predict participants' intentions to reduce their red and processed meat consumption. TPB variables were entered in block 1 and identity variables were entered in block 2, with intention to reduce red and processed meat as the dependent variable. The results are summarised in Table 7. As shown by the Table, the overall model including both TPB and identity variables significantly predicted participants' intentions to eat less red and processed meat ($R^2 = 0.48$, $F (7, 312) = 41.80$, $p < 0.001$, adjusted $R^2 = 0.47$). Adding the identity variables in block 2 explained an additional 2% of the variance in intention and significantly improved the model (R^2change = 0.02; F change $(3, 312) = 3.05$, $p = 0.029$). In the final model, only attitudes ($\beta = 0.85$, $p < 0.001$) and subjective norms ($\beta = 0.35$, $p < 0.001$) were statistically significant predictors of intention (see Table 7).

5.2.2.3 Section summary

Overall, these results show that intention to reduce red and processed meat was associated with positive attitudes, subjective norms, descriptive norms, perceived behavioural control, health and pro-environmental identity, but was negatively associated with meat-eater identity. The results showed that while pro-environmental, health and meat-eater identities explained additional variance in participants' intentions to reduce their red and processed meat consumption, the amount of variance explained by these variables was much smaller than that already accounted for by TPB predictors; attitudes, subjective norms, descriptive norms and perceived behavioural control. On the other hand, positive attitudes towards reducing red and processed meat and a strong perceived social pressure to do so, strongly predicted intentions to reduce ones' red and processed meat consumption when controlling for the other variables. Thus, intention to reduce one's red and processed meat consumption was the most strongly predicted by positive attitudes and a strong perceived social pressure from significant others to do so.

Table 6. Correlation coefficients for TPB and identity variables

	1	2	3	4	5	6	7	8	Mean	SD
1. Perceived behavioural control	-								5.70	0.89
2. Attitudes	.279**	-							4.83	.91
3. Intention	.159**	.647**	-						3.93	1.57
4. Subjective norms	.077	.469**	.500**	-					3.39	1.19
5. Descriptive norms	.113*	.227**	.127*	.163**	-				4.01	1.13
6. Health identity	.158**	.171**	.166**	-.031	.087	-			4.51	1.02
7. Pro-environmental identity	.088	.222**	.211**	.099	.028	.354**	-		4.54	1.04
8. Meat-eater identity	-.012	-.307**	-.276**	-.161**	-.109	-.122*	-.046	-	4.96	1.24

Note. * $p < 0.05$, ** $p < 0.01$.

Table 7. Hierarchical regression with TPB and identity variables as predictors of intention reduce red and processed meat

	b	SE (β)	β
Block 1			
Attitudes	0.93	0.09	0.54**
Subjective Norms	0.34	0.06	0.25**
Descriptive Norms	-0.05	0.06	-0.04
Perceived behavioural control	-0.01	0.08	-0.01
Block 2			
Attitudes	0.85	0.09	0.49**
Subjective Norms	0.35	0.06	0.26**
Descriptive Norms	-0.06	0.06	-0.04
Perceived behavioural control	-0.02	0.08	-0.01
Health Identity	0.11	0.07	0.07
Pro-environmental Identity	0.08	0.07	0.05
Meat Identity	-0.10	0.06	-0.08

Note. * $p < 0.05$, ** $p < 0.01$

5.2.3 A combined TTM/TPB Model

5.2.3.1 TPB variables across the stages of change

The TPB and TTM were combined to investigate the different psychosocial factors associated with an increased readiness to reduce one's red and processed meat consumption. Identity variables were not assessed in this model, given that identity appeared to have little effect on behavioural intentions to reduce red and processed meat consumption (see section 5.2.2). Average scores on the different TPB variables for participants in each stage of change are presented in Table 8. Observation of Table 8 shows a general increase in all of the TPB variables from precontemplation to action. The Table shows that participants' intentions and attitudes increased from precontemplation to action. Subjective and descriptive norms also increased from precontemplation to action, although participants had slightly higher scores in the preparation stage compared to the action stage. Perceived behavioural control also increased from precontemplation to action, however slightly higher scores were shown in the contemplation stage compared to the precontemplation stage.

A MANOVA was conducted to assess whether there were any significant differences in each of the TPB variables (intention, attitudes, subjective norms, descriptive norms and perceived behavioural control) across each stage of change (precontemplation, contemplation, preparation, action). Stage of change was the independent variable, with the TPB variables as dependent variables. The results indicated a significant effect of stage of change on the TPB variables (Pillai's trace = 0.63 (F (15, 942) = 16.54, p < 0.001). Univariate ANOVAs with Tukey-HSD post-hoc comparisons were used to follow-up this result. The results are presented below and are summarised in Table 8.

Intention

The results revealed significant differences in intention across the stages of change of change (F (3, 316) = 104.71, p < 0.001), where participants in the contemplation, preparation, and action stages had a significantly higher intention to reduce their red and processed meat consumption compared to those in the precontemplation stage (see Table 8). Those in the preparation and action stages also had significantly higher intentions than those in the contemplation stage. However, there was no significant difference in intention for those in the action and preparation stages. Thus, intention to reduce red and processed meat generally increased with participants' readiness to reduce their consumption, although intention was not significantly higher in the action compared to the preparation stage.

Attitudes

There were significant differences in attitudes across the stages of change (F (3, 316) = 57.29, $p < 0.001$), where participants in the contemplation, preparation and action stages had significantly more positive attitudes towards reducing their red and processed meat compared to those in the precontemplation stage (see Table 8). Those in the preparation and action stages also had significantly more positive attitudes towards reducing their red and processed meat consumption than those in the contemplation stage. However, there was no significant difference between the action and preparation stage. Thus, attitudes towards reducing red and processed meat became more positive with participants' readiness to reduce their red and processed meat consumption, although those in the action stage did not have significantly more positive attitudes compared to those in the preparation stage.

Subjective norms

Significant differences were also found for subjective norms across the stages of change (F (3, 316) = 30.89, $p < 0.001$), where participants in the contemplation, preparation and action stages scored significantly higher on the subjective norm measure compared those in the precontemplation stage (see Table 8). However, there was no significant difference between the contemplation stage and preparation stage, between the contemplation and action stage, or between the preparation and action stage. Thus, participants' perceived social pressure to eat less red and processed meat was significantly higher for those in the contemplation, preparation and action stages compared to those in precontemplation, but did not differ across any other stages.

Descriptive norms

A marginal but significant difference was also found for descriptive norms across the stages of change (F 3, 316) = 2.63, p = 0.050), As shown by Table 8, participants in the contemplation stage had significantly higher descriptive norms and thus viewed eating less red and processed meat as being more normal or commonplace, than those in the precontemplation stage. There were no significant differences in descriptive norms across the other stages.

Perceived behavioural control

Finally, there were significant differences in perceived behavioural control across the different stages of change (F (3, 316) = 6.78, p < 0.001), where participants in the contemplation stage had a significantly lower perceived behavioural control than those in the precontemplation stage (see Table 8). On the other hand, participants in the action stage had a significantly higher perceived behavioural control than those in the precontemplation stage. Perceived behavioural control was also significantly higher for those in the preparation and action stages compared to those in the contemplation stage. There was no significant difference between the preparation and action stage. Thus, there was some evidence that participants' perceived behavioural control in relation to reducing red and processed meat increased with their readiness to eat less red and processed meat. However, participants in the contemplation stage had a lower perceived behavioural control compared to those in the precontemplation stage, while perceived behavioural control increased from preparation to action and from contemplation to preparation and action.

5.2.3.2 Section summary

Overall, the results showed that an increased readiness to reduce one's red and processed meat consumption was associated with increased intentions, attitudes and perceived behavioural control, and to a lesser extent, increased perceived subjective and descriptive norms, relating to reducing one's red and processed meat consumption.

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Table 8. Comparison of TPB variables across the stages of change

	Tukey's HSD post-hoc comparisons				Mean	SD
	Precontemplation	Contemplation	Preparation	Action		
Intention						
Precontemplation	-				2.71	1.16
Contemplation	$p < 0.001^{**}$	-			3.82	1.13
Preparation	$p < 0.001^{**}$	$p < 0.001^{**}$	-		5.05	0.89
Action	$p < 0.001^{**}$	$p < 0.001^{**}$	$p = 0.798$	-	5.24	1.38
Attitudes						
Precontemplation	-				4.25	0.75
Contemplation	$p = 0.001^{**}$	-			4.72	0.67
Preparation	$p < 0.001^{**}$	$p < 0.001^{**}$	-		5.32	0.66
Action	$p < 0.001^{**}$	$p < 0.001^{**}$	$p = 0.292$	-	5.56	0.87
Subjective Norms						
Precontemplation	-				2.72	0.94

Contemplation	$p < 0.001^{**}$	-			3.67	1.01
Preparation	$p < 0.001^{**}$	$p = 0.348$	-		3.98	1.08
Action	$p < 0.001^{**}$	$p = 0.962$	$p = 0.696$	-	3.78	1.31
Descriptive norms						
Precontemplation	-				3.83	1.06
Contemplation	$p = 0.026^{*}$	-			3.92	1.02
Preparation	$p = 0.064$	$p = 0.431$	-		4.22	1.22
Action	$p = 0.230$	$p = 0.607$	$p = 1.00$	-	4.20	1.32
PBC						
Precontemplation	-				5.70	0.84
Contemplation	$p = 0.026^{*}$	-			5.29	0.87
Preparation	$p = 0.986$	$p = 0.019^{*}$	-		5.73	0.96
Action	$p = 0.047^{*-}$	$p < 0.001^{**}$	$p = 0.123$	-	6.08	0.80

Note. * $p < 0.05$, ** $p < 0.01$

5.3 Chapter summary and conclusions

5.3.1 General summary

This chapter uses baseline data collected as part of the second, quantitative, study in this thesis, and draws on behaviour change models to investigate the psychosocial factors associated with participants' willingness to reduce their red and processed meat consumption. First, the TTM is used to investigate participants' readiness to reduce their red and processed meat consumption, as well as participants' decisional balance and self-efficacy towards doing so, across the different stages of change. Second, the TPB is used to predict intentions to reduce red and processed meat as a function of attitudes, subjective norms, descriptive norms and perceived behavioural control, in addition to pro-environmental, health and meat-eater identities. Finally, differences in the TPB variables across each stage of change are assessed as part of a combined TTM/TPB model, to investigate the psychosocial factors associated with an increased readiness to reduce ones' red and processed meat consumption.

In line with existing literature, the results showed that most participants had not even considered reducing their red and processed meat consumption (e.g. Klöckner & Ofstad, 2017; Lea, et al.,2006; Weller et al., 2014). As expected, the majority of participants were in the precontemplation stage, with the remaining participants distributed across the other stages of change. Interestingly, more participants were in the preparation stage, compared to the contemplation and action stages. Thus, many participants were planning to reduce their red and processed meat consumption in the near future, while fewer participants had considered reducing their meat intake but had not made any attempt to do so, or had already taken action to reducing their consumption. There were no significant differences in the age, gender or level of study, of participants in the different stages of change, indicating that participants in the different stages of change were of similar demographics. There were also no significant differences in the amounts of red or processed meat consumed by participants across the different stages of change. Thus, an increased readiness to reduce red and processed meat did not appear to be associated with a significantly lower red and processed meat consumption, even if participants had already taken some action to reduce their red and processed meat intake. However, the descriptive statistics indicated that the average number of portions of red and processed meat consumed by participants was lower in the action stage compared to the precontemplation, contemplation and preparation stages. Thus, it is possible that the study simply did not have enough statistical power to detect a significant effect of stage of change on red and processed meat consumption, given the relatively small number of participants categorised into each stage; for example, only 48 participants were categorised in the action stage.

In accordance with the TTM the results showed that, in relation to reducing red and processed meat, the perceived benefits increased, and the perceived barriers decreased, from precontemplation to action (see Noia & Prochaska, 2010). This supports existing literature which has similarly demonstrated increased perceived benefits and decreased perceived barriers across the different stages of change, with regards to meat reduction (Lea et al., 2006; Weller et al., 2014). The perceived benefits associated with eating less red and processed meat were the lowest in the precontemplation stage, but the highest in the contemplation and preparation stages, rather than the action stage. This is in line with evidence that the perceived benefits of a behaviour can peak in the contemplation and preparation stages, declining once action has been taken (Prochaska, 1994). Overall these results support the TTM, which posits that the perceived benefits (or pros) of a behaviour increase from precontemplation to contemplation, while the perceived barriers (or cons) associated with a behaviour decrease, from contemplation to action (Prochaska & Velicer, 1997). Interestingly, it was found that the perceived barriers associated with red and processed meat reduction decreased approximately twice as much as the perceived benefits increased, from precontemplation to action. This contrasts with past literature which has demonstrated that the perceived barriers associated with a behaviour tend to decrease only half as much as the perceived benefits increase

(Hall & Rossi, 2008; Noia & Prochaska, 2010). This indicates that reducing perceived barriers is especially important in increasing a persons' readiness to reduce their red and processed meat consumption, whilst increasing the perceived benefits might not be as effective.

In line with the TTM, the results showed that an increased readiness to reduce red and processed meat was associated with increased perceived self-efficacy. While self-efficacy was significantly lower in the contemplation stage compared to the precontemplation stage, self-efficacy increased from the contemplation stage to the preparation and action stages, although it did not increase from preparation to action. This supports the TTM which suggests that self-efficacy should be low in the earlier stages of change, precontemplation and contemplation, and higher in the action stage (Diclemente, 1986; Diclemente et al., 1991; Diclemente, Prochaska, & Gibertini, 1985). This indicates that an increased perception that one is able to reduce their red and processed meat consumption is important in increasing a persons' readiness to do so.

The results showed that overall, participants viewed reducing their red and processed meat consumption positively and as being within their control. Participants did not feel a strong social pressure to reduce their red and processed meat consumption and did not view this as being a commonplace behaviour. Participants did not have particularly strong intentions to reduce their red and processed meat consumption, but were also not reluctant to do so. Interestingly, participants also had moderate pro-environmental and health identities, but identified more strongly as a meat-eater.

All TPB and identity variables positively correlated with intentions to reduce red and processed meat, except for meat-eater identity, which was negatively associated with intentions. This is consistent with previous literature also demonstrating a negative relationship between meat-eater identity and intentions to reduce red meat (Carfora et al., 2017b). Pro-environmental, health and meat-eater identities explained additional variance in participants' intentions to reduce their red and processed meat when controlling for the other TPB predictors, supporting the role of identity as an additional predictor of dietary intentions (e.g. Brouwer & Mosack, 2015; Carfora et al., 2017b; Dean, Raats & Shepherd, 2012). However, the amount of additional variance explained by these variables was only marginal compared to that already explained by the other TPB predictors and none of the identity variables were significant predictors of behavioural intentions in the final regression model. The final regression model showed that attitudes and subjective norms were the only significant predictors of participants' intentions to reduce their red and processed meat consumption, over and above the other TPB variables. Thus, participants who viewed reducing their red and processed meat positively and felt a strong perceived social pressure to reduce their red and processed meat consumption, had higher intentions to do so.

Finally, the results demonstrated that an increased readiness to reduce one's red and processed meat consumption was generally associated with increased behavioural intentions, positive attitudes, perceived behavioural control, subjective norms and descriptive norms. This is consistent with existing literature applying the TTM and TPB to understand meat reduction, which has similarly found an increase in the strength of these variables across the stages of change (e.g. Armitage & Arden, 2002; Wyker & Davidson, 2010). Interestingly, differences in the TPB variables were not always found between the different stages of change, suggesting that progression between different stages were associated with different psychosocial factors. For example, progression from precontemplation to contemplation was associated with increased descriptive norms, while no differences were found between contemplation and preparation for this variable. These results therefore provide useful information on the psychosocial factors associated with an increased readiness to reduce ones' red and processed meat consumption, which could be applied to the tailoring of interventions aimed at meat reduction.

In sum, most participants had not considered reducing their red and processed meat consumption at baseline; the majority of participants were in the precontemplation stage, with the remaining participants distributed across the other stages of change. Participants in the different stages of change were similar in terms of demographics and showed no significant differences in their red or processed meat consumption. In line with the TTM, progression from precontemplation to action was associated with increased self-efficacy, greater perceived benefits and fewer perceived barriers in relation to reducing red and processed meat. Unlike other health-related behaviours, the perceived barriers decreased with a greater magnitude than the perceived benefits increased, from precontemplation to action, for meat reduction. In line with the TPB, intention to reduce red and processed meat was predicted by attitudes, subjective norms, descriptive norms and perceived behavioural control, with additional variance being explained by pro-environmental, health and meat-eater identities. However, only attitudes and subjective norms predicted intention when controlling for all other TPB variables. Thus, the main psychosocial factors associated with intention to reduce red and processed meat were positive attitudes and a strong perceived social pressure towards doing so. Finally, the results showed variation in the different TPB variables, which tended to increase in strength, across the stages of change. In line with other similar studies, the TPB variables varied in a non-linear way and did not always differ between the stages of change. This suggests differences in the psychosocial factors associated with progression between different stages of change, as participants increase in their readiness to reduce their red and processed meat consumption.

5.3.2 Contributions to the literature

This study contributes to the literature by providing a comprehensive investigation of the psychosocial factors associated with an increased willingness to reduce one’s red and processed meat consumption. Few studies have applied the TTM to investigate reduced meat diets, while those that have tended to focus on the stages of change component, without investigating self-efficacy or decisional balance (e.g. Culliford & Bradbury, 2020; Tobler et al., 2011). Although some studies have applied the stages of change with decisional balance in relation to adopting a plant-based diet (Lea et al., 2006), and have applied the stages of change with self-efficacy and decisional balance in relation to 'green-eating' (Weller et al., 2014), this is the first study to investigate the stages of change combined with decisional balance and self-efficacy in relation to reducing red and processed meat consumption. By investigating decisional balance with self-efficacy across the stages of change, this study contributes to a greater understanding of the psychological processes involved as an individual progresses in their readiness to reduce their red and processed meat consumption.

The findings showed that self-efficacy generally increased from earlier to later stages of change, meaning participants' readiness to reduce their red and processed meat consumption increased with their perceived ability to do so. This supports the findings from Weller et al. (2014), who similarly found that self-efficacy increased across the stages of change in relation to 'green-eating'. On the other hand, the findings showed that for reducing one's red and processed meat consumption, self-efficacy did not increase in a linear way across the different stages. Self-efficacy was lower for participants in the contemplation stage compared to those in the pre-contemplation stage. This suggests that individuals contemplating reducing their red and processed meat consumption may feel that they will not be able to achieve this, potentially keeping them in the contemplation stage of change. For example, individuals in this stage can become stuck in 'chronic contemplation', otherwise known as 'behavioural procrastination' (Prochaska & Velicer, 1997). This suggests that encouraging a strong self-efficacy will be important in encouraging individuals to progress from thinking about reducing their red and processed meat consumption to taking action.

The results showed that the perceived benefits increased and the perceived barriers decreased, from the earlier to later stages of change. This adds to existing literature which has shown a similar pattern in decisional balance with regards to eating a plant-based diet (Lea et al., 2006). However, the current findings showed that the perceived barriers associated with red and processed meat reduction decreased approximately twice as much as the perceived benefits increased, from precontemplation to action. This contrasts with evidence which found the perceived benefits increased with a greater magnitude than the perceived barriers decreased from pre-contemplation to action for 'green-eating' behaviour (Weller et al., 2014). This provides insight into the psychological processes associated with an increased readiness to reduce one's red and processed meat. Specifically, reducing perceived barriers will be especially important in increasing a persons' readiness to reduce their red and processed meat consumption, while increasing the perceived benefits might be more relevant for encouraging other types of dietary change such as 'green-eating', which includes eating locally grown and seasonal foods, limiting consumption of processed foods, consuming fair trade and organic foods, consuming regular meatless meals weekly and selecting meats, poultry, and dairy that do not contain hormones or antibiotics (Weller et al., 2014).

This study also adds to the existing literature which has found mixed evidence with regards to the psychosocial predictors of reduced meat consumption. The present study found only attitudes and subjective norms to be significant predictors of intentions to reduce red and processed meat. This supports past literature also evidencing the role of attitudes (e.g. Lentz, et al., 2018; Zur & Klöckner, 2014), and subjective norms (e.g. Graca et al., 2015; Povey et al., 2001; Wyker & Davidson, 2010) to be significant predictors of intentions to eat less meat. The present study therefore adds to this evidence base, showing that positive attitudes and a high perceived social pressure to reduce one's consumption, are important motivations for reducing one's red and processed meat consumption.

This study provides a novel contribution to the literature by examining differences in attitudes, subjective norms, descriptive norms and perceived behavioural control as a person increases in their readiness to reduce their red and processed meat consumption. Wyker and Davison (2010) previously showed that the TPB variables tended to increase in valence from pre-contemplation to preparation/action, in relation to eating a plant-based diet. In their study, the preparation and action stages were combined due to low participant numbers in these stages. The present study also showed low participant numbers in the action stage and did not find any significant differences in the TPB variables between the preparation and action stages. Therefore, the current findings closely align with those from Wyker and Davison (2010), demonstrating that few individuals tend to be in the action stage with regards to reducing their meat consumption. Moreover, the findings similarly showed that the TPB variables tended to increase in strength across the stages of change. This suggests that increasing positive attitudes, subjective norms and perceived behavioural control can help individuals to increase in their readiness to reduce their red and processed meat consumption. Future intervention techniques could therefore focus on encouraging positive attitudes, in addition to strong subjective norms and perceived behavioural control, to encourage reduced red and processed meat consumption (see Fife-Schaw, Sheeran & Norman, 2007).

Chapter 6: The Effectiveness of Environmental, Health and Combined Messages on Reducing Red and Processed Meat Consumption

6.1 Introduction

This chapter addresses the second aim of this thesis (see chapter 2, section 2.6), to investigate the effectiveness of providing information on the environmental, health and combined environmental and health impacts of red and processed meat, on reducing participants' red and processed meat consumption. Following this, this chapter also aims to investigate the types of food used to replace red and processed meat. This is done by reporting on the findings of the randomised messaging intervention, conducted as part of the second study presented in this thesis (see chapter 3, section 3.6.2). The study uses both surveys and food diaries to address these aims. Survey data is commonly used in studies investigating meat consumption and can provide a low effort measure of consumption (e.g. see Bianchi et al., 2018; Harguess et al., 2020). On the other hand, food diaries can encourage a greater adherence with dietary programmes and can increase participants' awareness of their food choices (Zepeda & Deal, 2008). Food diaries can also allow for a more detailed measure of consumption, as food choices can be reported on a day-to-day basis and with different response options for different serving sizes (Zepeda & Deal, 2008). However, asking participants to record their food intake every day for two weeks, as with the current study, can be burdensome for participants leading to higher drop-out rates, while the quality of consumption data can also decrease over time (Lambe et al., 2000). Thus, it was hoped that combining both survey and diary methods would provide a rich account of participants' consumption, whilst compensating for some of the limitations of each individual method. First, survey data is used to compare differences in participants' consumption of red, processed and white meat, during the intervention and one month later, compared to baseline. The data from food diaries completed during each day of the two-week intervention is then used to compare participants' consumption of red and processed meat, as well as white meat, fish and plant-based meat alternatives (see chapter 3, section 3.6.2).

This chapter is exploratory, given that interventions aimed at encouraging a reduced meat consumption are just emerging in the literature (see chapter 2). However, based on the literature reviewed in chapter 2, it was expected that participants in the environment and health conditions would significantly reduce their red and processed meat consumption during the intervention compared to baseline, while no such change was expected for those in the control condition (e.g. Bertolotti et al., 2019; Graham & Abrahamse, 2017; Jagers et al., 2017; Stea & Pickering, 2019). It was not known whether participants would reduce their red and processed meat consumption one month after the intervention, given that most studies have tested the effects of information on reducing meat consumption during or shortly after an intervention, but at no later time point (see chapter 2, section 2.4). It was not known whether participants in the combined condition would reduce their red and processed meat consumption either during the intervention or one month later, given previous mixed evidence on the effectiveness of combined messages on meat reduction (e.g. Amiot et al., 2018; Carfora et al., 2019a). Finally, it was not known what types of food would be used by participants to replace red and processed meat in their diet during the intervention. However, previous literature has indicated white meat, fish, and pant-based meat alternatives to be viable options (e.g. Becerra-Tomas et al., 2016; Hoek et al., 2011). Thus, it was thought that participants in the experimental (environment, health, combined) conditions might show an increased consumption of white meat, fish and plant-based alternatives compared to participants in the control condition, if these foods are used to replace red and processed meat during the intervention.

This chapter will first discuss the statistical techniques used to analyse both types of data (section 6.2), before reporting the results of the intervention study (section 6.3) and providing a brief summary and conclusion for this chapter, including discussion of the novel contributions offered by this work (section 6.4).

6.2 Statistical analysis

6.2.1 Survey data

6.2.1.1 Outcome variables

Participants' consumption of red and processed meat was first assessed through a single outcome variable 'red/processed meat', given that the intervention specifically encouraged participants to reduce their consumption of both red and processed meat. Participants' consumption of red and processed meat was then assessed independently through two separate outcome variables 'red meat' and 'processed meat', to investigate whether the intervention had differing effects on the consumption of each meat. Participants' consumption of white meat was also assessed, to investigate whether the effects of the intervention was limited to the type of meat that was targeted (i.e. red and processed meat), and to investigate whether participants would show an increased consumption of white meat, as a replacement for red and processed meat. For each outcome variable, participants were asked to record the number of portions they had consumed during the *previous week* (see chapter 3, section 3.6.2). This was measured at baseline, shortly after the intervention and one month following from this. Thus, the measures reflect the number of portions consumed by participants during one week before the intervention (T1), during the second week of the intervention (T2) and at a month follow-up, four weeks after the intervention (T3). The correlation between white, red and processed meat across the different time points can be viewed in Appendix I. The investigation of the grouped red/processed meat variable can be supported by the fact that red and processed meat consumption was significantly correlated across all time points (see Appendix I).

6.2.1.2 Statistical analysis

The survey data was analysed using a multilevel modelling approach with a repeated measures design. Multilevel models can be defined as a series of interrelated regression models that explain variance at multiple levels, in this case being the individual (participant) and measurement (time of recorded meat consumption) level (Hoffman & Rovine, 2007). They distinguish fixed effects, that is the effects of variables that are consistent across all individuals within the sample, from random effects, which vary across all individuals within the sample. Individual measurements (e.g. meat consumption) are treated as randomly sampled elements nested within individuals. Multilevel models offer considerable advantages over traditional techniques. For example, unlike analysis of variance (ANOVA), multilevel models are robust to violations of sphericity i.e. unequal error variances across time, that can otherwise cause inflation of type 1 error rates (Quené & Van Den Bergh, 2004). This is relevant to the current study given that participants' red and processed meat consumption is likely to vary considerably at baseline, with less variation potentially being present after the intervention, if it is successful in reducing participants' meat consumption. Furthermore, multilevel models predict individual rather than group change as time is treated as a random effect, meaning individual variability in rates of change, i.e. in meat reduction, can be assessed. Moreover, multilevel models allow for the comparison of individual change even where missing data is present, providing data is missing at random (Gueorguieva & Krystal, 2004). This is also relevant for the current study, where 320 participants answered the baseline survey at T1, while 251 participants answered the survey at T2, and 238 participants answered the survey at T3 (see chapter 3, section 3.6.2.1). following from this, multilevel models are preferred over repeated measures ANOVA, which has a listwise detection of individuals resulting in a loss of data and causing smaller potentially biased sample sizes.

Separate mixed linear models were conducted using SPSS (version 25 for mac) to model changes in meat consumption over time, for each of the outcome variables noted in the previous section (6.2.1.1). A hierarchical structure was used with time of reported meat consumption (T1, T2, T3) at level one, nested within participants at level two. Each model included time (T1, T2, T3) and condition (control, environment, health, combined), with a time*condition interaction term, as fixed variables. Time and condition were dummy coded. The environment, health and combined messaging conditions were compared to the control group, which was the reference category for condition. Red, white, and processed meat consumption during the intervention (T2), and one month later (T3), was compared to baseline (T1), which was the reference category for time. Each model was able to assess the effect of condition on participants' meat consumption when controlling for the effects of time and the effect of time on participants' consumption when controlling for the effects of condition, as well as being able to test for any differences in the effects of the intervention between the conditions over time. Each model included randomly varying intercepts and fixed slopes, with a first-order autoregressive heterogeneous structure. In other words, the data was modeled assuming that there would be variation in the amount of meat consumed by participants (random intercepts), that the effect of the intervention on meat consumption would be the same across participants (fixed slopes), and that the variance in meat consumption would change in a systematic, heterogenic way (first-order autoregressive heterogeneous co-variance structure; see Field, 2009).

6.2.2 Diary data

6.2.2.1 Outcome variables

As with the survey data, participants' consumption of red and processed meat was first assessed together through a single outcome variable 'red/processed meat', to investigate the overall effect of the intervention on participants' red and processed meat consumption. Red and processed meat consumption was then assessed independently through two separate outcome variables 'red meat' and 'processed meat', to assess whether the effects of the intervention had differing effects on the consumption of each type of meat. Participants' consumption of white meat, fish and plant-based meat alternatives was also assessed, to investigate whether participants might increase their consumption of these replacement foods, as a result of eating less red and processed meat. Participants' consumption of white meat, fish and plant-based alternatives was first assessed through a single outcome variable 'alternatives to red and processed meat', to assess the effect of the intervention on participants consumption of these alternative choices to red and processed meat. Participants' consumption of each alternative; white meat, fish, and plant-based alternatives, was then assessed through separate outcome variables 'white meat', 'fish' and 'plant-based alternatives', to investigate the independent effect of the intervention on participants' consumption of each alternative.

For each outcome variable, consumption was measured as the number of portions consumed by participants each day during the intervention, as recorded by participants using the food diaries. However, a floor effect was found where very few portions of red meat, processed meat, white meat, fish and plant-based alternatives were consumed by participants during each day of the intervention (see Appendix J). This is likely to result from the fact that only a certain amount of food can be consumed by a person on any given day. Appendix J shows that on most days, the majority of participants did not consume a single portion of red meat, processed meat, white meat, fish or plant-based alternatives, with few participants consuming one or more portions. Thus, the data for these variables was not normally distributed. Based on this, the data was transformed to binary outcome variables representing whether participants did or did not consume each food on each day of the intervention, rather than focussing on the number of portions consumed[16]. Thus, analysis was used to establish the effect of the intervention on participants' likelihood of consuming each of the food groups, rather than comparing differences in the number of portions consumed. It should also be noted that the food diaries

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[16] It should be noted that transforming continuous data to binary outcome variables has been criticised as a practice, as this approach can lead to a loss of variability and power, as well as useful information about outcomes (e.g. Fedorov, Mannino, Zhang, 2009). However, this was not thought to be problematic for the current data, given that variability was already very low, while comparing whether or not each food was consumed still provides useful information regarding the effects of the intervention on participants' consumption of red and processed meat consumption as well as potential meat replacements.

were used by participants during the intervention only, and therefore cannot be used to make comparisons from before or after the intervention took place.

6.2.2.2 Statistical analysis

The diary data was analysed using time-series analysis. This type of analysis can be used to analyse data from longitudinal designs involving multiple observations of participants over time, to provide insight into underlying patterns of behaviour change (Velicer & Fava, 2003). In this study, binomial time-series analysis was used to investigate patterns in the likelihood of participants consuming each of the food groups noted in the previous section (6.2.2.1), across each day of the two-week (14 day) intervention period. This was done using MLwiN (version 2.36 for Windows). Separate models were conducted for each of the outcome variables (see section 6.2.2.1). A multilevel approach was used with a hierarchical structure, with time (day of the intervention) at level one, nested within participants at level two. Each model included time (day of intervention), condition (control, environment, health, combined), and a time*condition interaction term, as fixed variables. Conditions were dummy coded so that the environment, health and combined conditions were compared to the control group, which was the reference category. Time was included as a continuous variable (day 1-14), so that change in the likelihood of consumption could be modelled across each day of the intervention. Each model was able to assess the effect of condition on participants' food consumption when controlling for the effects of time, as well as the effect of time on participants' consumption when controlling for the effects of condition. Including the interaction term meant that any differences in the effects of the intervention could be modelled across the two-week period. Each model included randomly varying intercepts and fixed slopes. Thus, the data was modelled assuming variation in the likelihood of participants consuming the different food groups (random intercepts), but that the effect of time on consumption would be the same across participants (fixed slopes).

6.3 Results

6.3.1 Results from the survey data

6.3.1.1 Grouped red/processed meat consumption

Participants' average reported consumption of red/processed meat is summarised in Figure 6. The Figure shows that that all participants ate a high amount, approximately 7 portions, of red/processed meat during the baseline week (control: M = 7.03, SE = 0.40; environment: M = 7.01, SE = 0.38; health: M = 7.59, SE = 0.39, combined M = 7.35, SE = 0.37). Participants in the environment (M = 4.18, SE = 0.42), health (M = 4.62, SE = 0.45), and combined conditions (M = 4.34, SE = 0.41) appeared to reduce their red/processed meat consumption during the two-week intervention, while participants in the control condition did not appear to reduce their consumption (M = 7.37, SE = 0.45). However, all participants appeared to reduce their red/processed meat one month after the intervention compared to baseline (control: M = 5.05, SE = 0.40; environment: M = 3.95, SE = 0.36; health: M = 4.61, SE = 0.39; combined: M = 3.65, SE = 0.36).

The results from the multilevel model are summarised in Table 9. The Table shows that there was no significant main effect of condition when controlling for time (*p*s > 0.05). There was no main effect of time when controlling for condition during the intervention (b = 0.34, p = 0.522). There was however a significant interaction between time and condition, where participants in the environment (b = -3.17, p < 0.001), health (b = -3.31, p < 0.001) and combined (b = -3.35, p < 0.001) conditions significantly reduced their red/processed meat consumption during the intervention compared to baseline and compared to participants in the control condition. There was a significant main effect of time one month after the intervention, where all participants significantly reduced their consumption of red/processed meat compared to baseline (b = -1.99, p < 0.001). There was also a significant interaction between time and condition one month after the intervention, where participants in the combined condition significantly reduced their red/processed meat consumption compared to baseline and compared to control participants (b = -1.72, p = 0.009). There were no significant interaction effects between time and the environment or health conditions, one month after the intervention (ps > 0.05).

These results indicate that providing information on the environmental, health and the combined environmental and health impacts of meat, was successful in encouraging participants to reduce their red/processed meat consumption. However, while participants in the environment, health and combined conditions significantly reduced their red/processed meat consumption during the intervention compared to baseline and compared to control participants, all participants, including those in the control condition, significantly reduced their red/processed meat consumption one month after the intervention had ended. Thus, the evidenced reduction in red/processed meat might not be entirely attributable to the information provided during the intervention, given that participants in the control condition did not receive any information on the different impacts of meat, but still reduced their red/processed meat consumption at the month follow-up. On the other hand, participants in the combined condition reduced their red/processed meat consumption to a significantly greater extent than those in the control condition at this time. This suggests that providing information on the combined environmental and health impacts of meat was particularly effective in reducing participants' red/processed meat consumption one month later.

The mean differences in red/processed meat consumption reported by participants during the intervention compared to baseline, and one month after the intervention compared to baseline, were calculated and compared across the different messaging conditions. Interpretation of the confidence intervals showed that there were no significant differences between the environment and health condition (M difference = -0.14, CI = -1.16, 0.88), the health and combined condition (M difference = 0.04, CI = -1.11, 1.19) or the environment and combined condition (M difference = 0.18, CI = -0.82, 1.17) in reducing participants' red/processed meat consumption during the intervention. There were also no significant differences between the environment and health condition (M difference = -0.06, CI = -1.03, 0.91), the health and combined condition (M difference = 0.38, CI = -0.61, 1.36), or the environment and combined condition (M difference = 0.43, CI = -0.48, 1.35), in reducing participants' red/processed meat consumption one month after the intervention. Thus, there were no significant differences in the extent to which participants in the health, environment and combined conditions reduced their red/processed meat consumption during the intervention or one month later, compared to baseline. This means that although only participants in the combined condition reduced their red/processed meat consumption significantly more than participants in the control condition at the one-month follow-up, these participants did not reduce their red/processed meat consumption significantly more than those in the environment or health conditions.

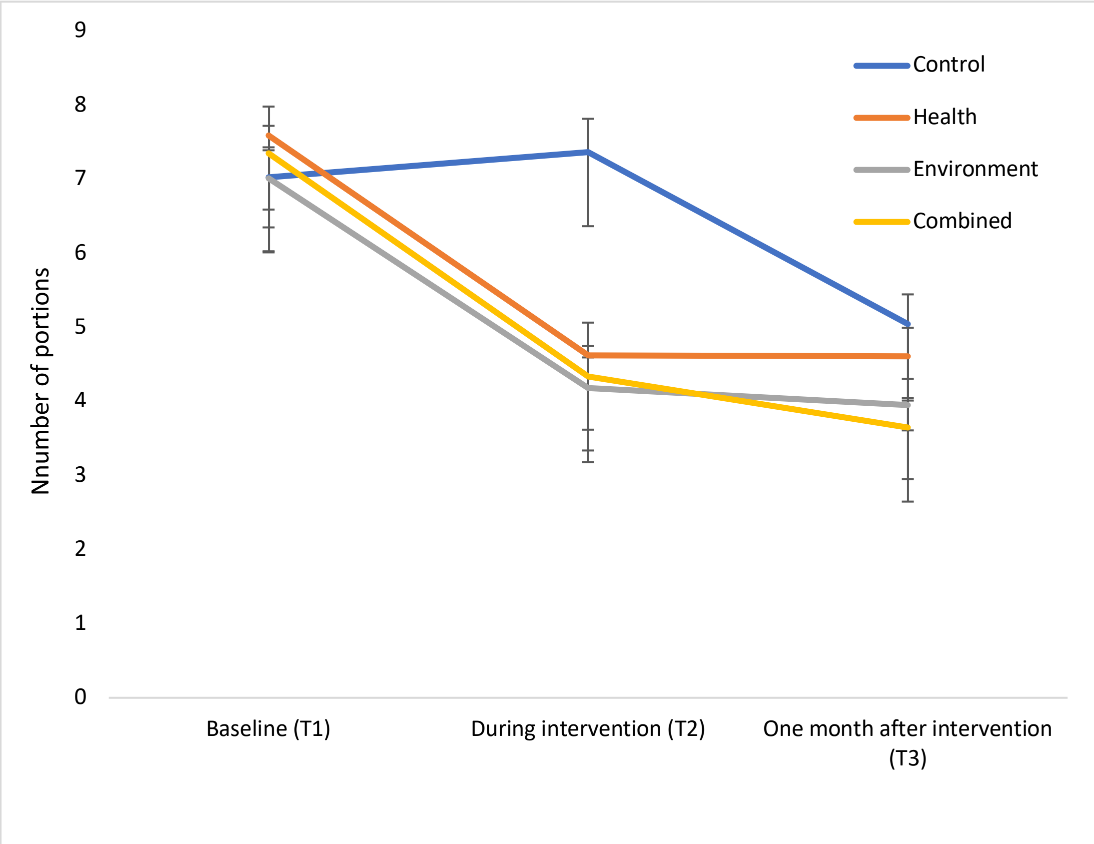

Figure 6. Average red/processed meat consumption across time. Error bars represent standard error +/- mean.

Table 9. Multilevel model regression coefficients for red/processed meat consumption

Predictors	B	SE (B)	df	t	p	95% CI	
						Lower	Upper
Intercept	7.03	0.40	334.36	17.43	<0.001**	6.23	7.82
Time							
Time 2	0.34	0.53	388.11	0.641	0.522	-0.70	1.38
Time 3	-1.99	0.49	363.65	-4.09	0.000**	-2.94	-1.03
Condition							
Health	0.56	0.56	334.36	1.00	0.317	-0.54	1.67
Environment	-0.02	0.55	334.36	-0.03	0.978	-1.10	1.07
Combined	0.32	0.55	334.36	0.59	0.558	-0.76	1.40
Interactions							
Time 2 * Health	-3.31	0.74	388.11	-4.47	<0.001**	-4.76	-1.85
Time 2 * Environment	-3.17	0.72	387.38	-4.41	<0.001**	-4.59	-1.76
Time 2 * Combined	-3.35	0.72	387.52	-4.69	<0.001**	-4.75	-1.95
Time 3 * Health	-1.00	0.68	363.80	-1.48	0.140	-2.32	0.33
Time 3 * Environment	-1.08	0.65	360.56	-1.65	0.100	-2.37	0.21
Time 3 * Combined	-1.72	0.66	362.58	-2.62	0.009**	-3.01	-0.43

Note: Time 2 = during intervention, Time 3 = one month after intervention.

$^{*}p < 0.05$, $^{**}p < 0.01$

6.3.1.2 Red meat consumption

The previous section showed that the messaging intervention had a significant effect on reducing participants' red and processed meat consumption, when red and processed meat was investigated together as a single outcome variable. Participants' consumption of red and processed meat was then investigated separately, to establish if the intervention had differing effects on each type of meat respectively (see section 6.2.1). First, participants' consumption of red meat was investigated. Participants' average reported consumption of red meat is summarised in Figure 7. The Figure shows that all participants ate a moderate amount of red meat, approximately 4 portions, during the baseline week (control: M = 4.07, SE = 0.20; environment: M = 4.05, SE = 0.19; health: M = 4.40, SE = 0.20; combined: M = 4.26, SE = 0.19). Participants in the control condition appeared to eat a higher amount of red meat during the intervention (M = 4.07, SE = 0.24), compared to those in the environment (M = 2.33, SE = 0.22), health (M = 2.43, SE = 0.24), and combined conditions (M = 2.42, SE = 0.22) who appeared to reduce their consumption at this time. All participants appeared to eat less red meat one month after the intervention had ended relative to baseline (control: M = 2.58, SE = 0.25; environment: M = 2.12, SE = 0.22; health: M = 2.62, SE = 0.24; combined: M = 2.13, SE = 0.23).

The results from the multilevel model are summarised in Table 10. As shown by Table 10, there was no significant main effect of condition when controlling for the effect of time (*p*s > 0.05). There was however a significant interaction between time and condition, where participants in the health (b = -1.98, p < 0.001), environment (b = -1.72, p < 0.001) and combined (b = -1.85, p < 0.001) conditions significantly reduced their red meat consumption during the intervention compared to baseline and compared to control participants. There was no main effect of time during the intervention (b = 0.01, p = 0.983). However, there was a significant main effect of time one month after the intervention, where all participants consumed significantly less red meat compared to baseline (b = -1.49, p < 0.001). There were no significant interactions between time and the environment, health or the combined conditions, one month after the intervention (*p*s > 0.05).

These results show that providing information on the environmental, health, and combined environmental and health impacts of meat, was successful in reducing red meat consumption during the intervention and one month after the intervention had ended. However, the fact that participants in the control condition also reduced their red meat consumption one month after the intervention suggests that some aspect of the intervention, other than information provision, might have contributed to participants' reduced red meat consumption at this time.

The mean differences in red meat consumption reported during the intervention compared to baseline, and at one month after the intervention compared to baseline, were calculated and compared across the environment, health, and combined conditions. Interpretation of the confidence intervals showed that there was no significant difference between the environment and health condition (M difference = -0.25, CI = -0.80, 0.29), the combined and health condition (M difference = -0.13, CI = -0.74, 0.48) or the environment and combined condition (M difference = 0.12, CI = -0.43, 0.68), in reducing participants' red meat consumption during the intervention compared to baseline. There was also no significant difference between the environment and health condition (M difference = 0.15, CI = -0.04, 0.68), the health and combined condition (M difference = 0.35, CI = -0.18, 0.89) or between the environment and combined condition (M difference = 0.20, CI = -0.33, 0.73) in reducing participants' red meat consumption one month after the intervention compared to baseline. Thus, there were no significant differences in the extent to which participants in the health, environmental and combined conditions reduced their red meat consumption during the intervention or one month later, compared to baseline.

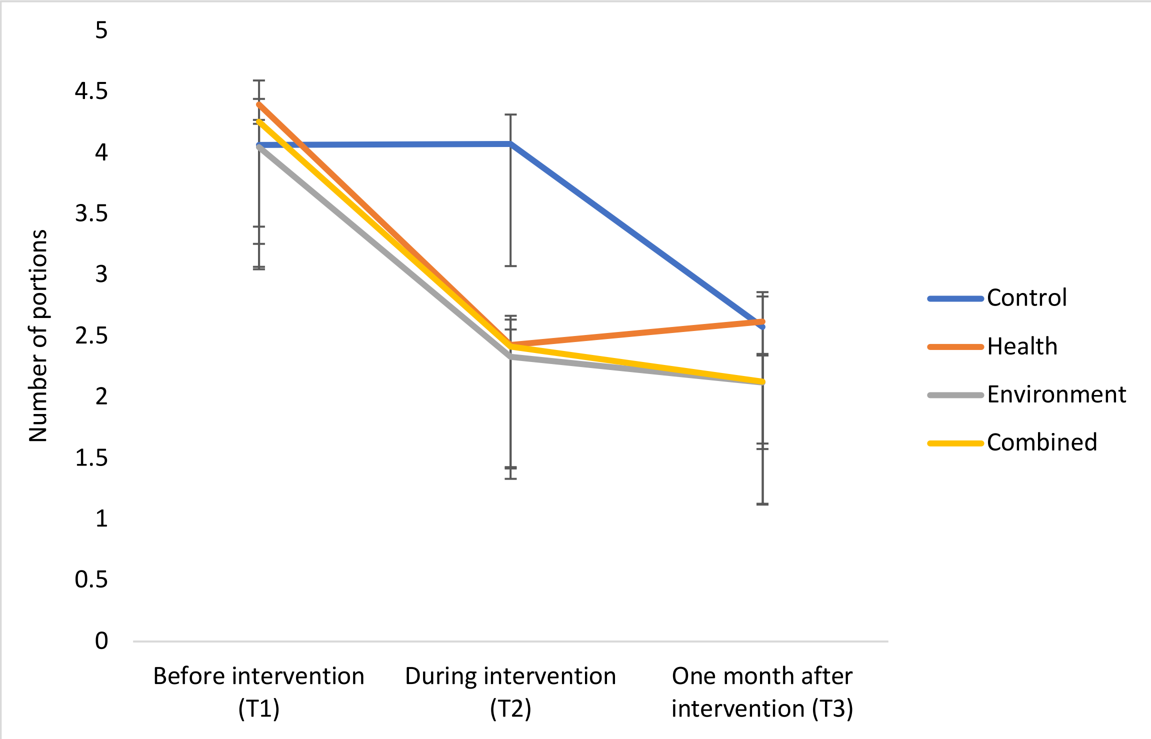

Figure 7. Average red meat consumption across time. Error bars represent standard error +/- mean.

Table 10. Multilevel model regression coefficients for red meat consumption

Predictors	B	SE (B)	df	t	p	95% CI	
						Lower	Upper
Intercept	4.07	0.20	327.60	20.01	<0.001**	3.67	4.47
Time							
Time 2	0.01	0.28	373.54	0.02	0.983	-0.53	0.55
Time 3	-1.49	0.28	321.38	-5.30	<0.001**	-2.05	-0.94
Condition							
Health	0.33	0.28	327.60	1.16	0.246	-0.23	0.89
Environment	-0.02	0.28	327.60	-0.07	0.942	-0.57	0.53
Combined	0.19	0.28	327.60	0.68	0.499	-0.36	0.73
Interactions							
Time 2 * Health	-1.98	0.39	373.50	-5.13	<0.001**	-2.73	-1.22
Time 2 * Environment	-1.72	0.37	373.02	-4.61	<0.001**	-2.46	-0.99
Time 2 * Combined	-1.85	0.37	373.12	-4.97	<0.001**	-2.58	-1.12
Time 3 * Health	-0.28	0.39	321.61	-0.73	0.469	-1.05	0.49
Time 3 * Environment	-0.43	0.38	320.92	-1.15	0.251	-1.18	0.31
Time 3 * Combined	-0.64	0.38	320.98	-1.67	0.096	-1.39	0.11

Note: Time 2 = during intervention, Time 3 = one month after intervention.

$^{*}p < 0.05$, $^{**}p < 0.01$

6.3.1.3 Processed meat consumption

Participants' average reported processed meat consumption is summarised in Figure 8. The Figure shows that participants ate a relatively low amount of processed meat, approximately 3 portions, during the baseline week (control: M = 2.96, SE = 0.27; environment: M = 2.96, SE = 0.25; health: M = 3.19, SE = 0.26; combined: M = 3.09, SE = 0.25). Participants in the health (M = 2.21, SE = 0.27), environment (M = 1.84, SE = 0.25) and combined conditions (M = 1.92, SE = 0.25) appeared to reduce their processed meat consumption during the intervention, and participants in the control condition appeared to slightly increase their consumption (M = 3.29, SE = 0.27). All participants appeared to eat less processed meat one month after the intervention compared to baseline (control: M = 2.47, SE = 0.22; environment: M = 1.83, SE = 0.19; health: M = 2.00, SE = 0.21; combined: M = 1.52, SE = 0.20).

The results from the multilevel model are summarised in Table 11. As shown by the Table, there was no significant main effect of time when controlling for the effect of condition (*p*s > 0.05). There was also no significant main effect of condition when controlling for the effect of time (*p*s > 0.05). However, there was a significant interaction between time and condition where participants in the health (b = -1.31, p = 0.006), environment (b = -1.45, p = 0.002) and combined (b = -1.50, p = 0.001) conditions significantly reduced their processed meat consumption during the intervention compared to baseline and compared to participants in the control condition. There was also a significant interaction where participants in the combined condition significantly reduced their processed meat consumption one month after the intervention compared to baseline and compared to participants in the control condition (b = -1.08, p = 0.008). There were no significant interaction effects between time and the health or environment conditions, one month after the intervention (*p*s > 0.05).

Thus, the results indicate that providing information on the environmental, health and combined environmental and health impacts of meat was successful in encouraging participants to reduce their processed meat consumption during the intervention, while only those who received combined information on the health and environmental impacts of meat continued to eat less processed meat one month after the intervention.

The mean differences in processed meat consumption reported during the intervention compared to baseline, and one month after the intervention compared to baseline, were calculated and compared across the different messaging conditions. Interpretation of the confidence intervals showed that there were no significant differences in the extent to which participants in the environment and health condition (M difference = 0.13, CI = -0.52, 0.79), the health and combined condition (M difference = 0.19, CI = -0.54, 0.91) or the environment and combined condition (M difference = 0.05, CI = -0.53, 0.66) reduced their processed meat consumption during the intervention compared baseline. There were also no significant differences in the extent to which participants in the environment and health condition (M difference = -0.06, CI = -0.70, 0.58), the health and combined condition (M difference = 0.38, CI = -0.26, 1.01) or the environment and combined condition (M difference = 0.43, CI = -0.14, 1.01) reduced their processed meat consumption one month after the intervention compared to baseline. Thus, the extent to which participants in the different experimental conditions reduced their processed meat consumption did not significantly differ. This means that, although only participants in the combined condition reduced their processed meat consumption one month after the intervention compared to baseline, participants in the combined condition did not reduce their processed meat consumption significantly more than those in the health or environment conditions.

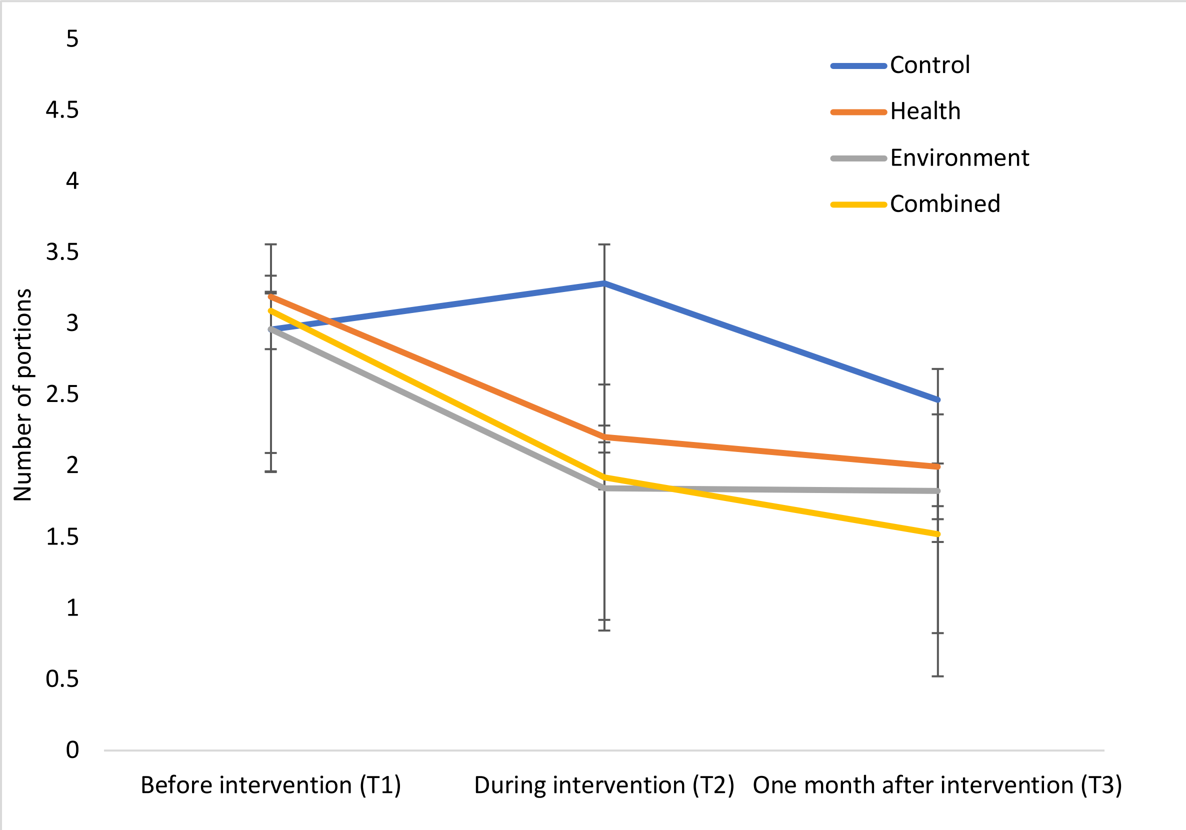

Figure 8. Average processed meat consumption across time. Error bars represent standard error +/- mean.

Table 11. Multilevel model regression coefficients for processed meat consumption

Predictors	B	SE (B)	df	t	p	95% CI	
						Lower	Upper
Intercept	2.96	0.27	334.59	11.06	<0.001**	2.43	3.49
Time							
Time 2	0.33	0.34	424.48	0.96	0.338	-0.34	1.00
Time 3	-0.49	0.30	390.82	-1.65	0.100	-1.08	0.10
Condition							
Health	0.23	0.37	334.59	0.63	0.531	-0.50	0.97
Environment	0.01	0.37	334.59	0.01	0.989	-0.72	0.73
Combined	0.13	0.36	334.59	0.37	0.713	-0.58	0.85
Interactions							
Time 2 * Health	-1.31	0.48	424.74	-2.74	0.006**	-2.26	-0.37
Time 2 * Environment	-1.45	0.47	423.47	-3.11	0.002**	-2.36	-0.53
Time 2 * Combined	-1.50	0.46	423.67	-3.25	0.001**	-2.41	-0.59
Time 3 * Health	-0.70	0.42	390.76	-1.70	0.091	-1.52	0.11
Time 3 * Environment	-0.65	0.40	384.48	-1.60	0.110	-1.44	0.15
Time 3 * Combined	-1.08	0.41	388.98	-2.67	0.008**	-1.88	-0.28

Note: Time 2 = during intervention, Time 3 = one month after intervention.

$^{*}p < 0.05$, $^{**}p < 0.01$

6.3.1.4 White meat consumption

Participants' average reported consumption of white meat is summarised in Figure 9. As shown by the Figure, participants in all of the conditions tended to eat a moderate amount of white meat, approximately 4 portions, at baseline (control: M = 3.88, SE = 0.26; environment: M = 4.18, SE = 0.24; health: M = 4.78, SE = 0.25; combined M = 4.07, SE = 0.24), with little change shown during the intervention (control: M = 3.86, SE = 0.30; environment: M = 4.43, SE = 0.27; health: M = 4.37, SE = 0.29; combined: M = 4.63, SE = 0.27), or one month later (control: M = 3.35, SE = 0.30; environment: M = 3.43, SE = 0.27; health: M = 4.24, SE = 0.29; combined: M = 3.53, SE = 0.27).

The results from the multilevel model are summarised in Table 12. As shown by the Table, there was no significant main effect of time when controlling for the effect of condition (*p*s > 0.05). However, there was a significant effect of condition when controlling for the effect of time, where participants in the health condition consumed significantly more white meat compared to participants in control condition (b = 0.90, p = 0.012). There was no main effect for the environment or combined conditions (*p*s > 0.05). There were also no significant interaction effects between time and the health, environment, or combined conditions, during the intervention or one month later (*p*s > 0.05).

These results show that participants in the health condition consumed significantly more portions of white meat compared to participants in the control condition. However, this effect was present throughout the entire study duration, indicating that these participants did not increase their consumption during (or after) the intervention compared to baseline. In fact, observation of Figure 9 indicates a small decrease in the amount of white meat consumed during the intervention and at the month follow-up compared to baseline, for participants in the health condition. Thus, the results do not support that participants in the health condition used white meat as a replacement for red and processed meat. Differences in the extent to which participants changed their white meat consumption were not calculated or compared across the different messaging conditions, given that participants did not show any significant changes in their white meat consumption during the intervention or one month later, compared to baseline.

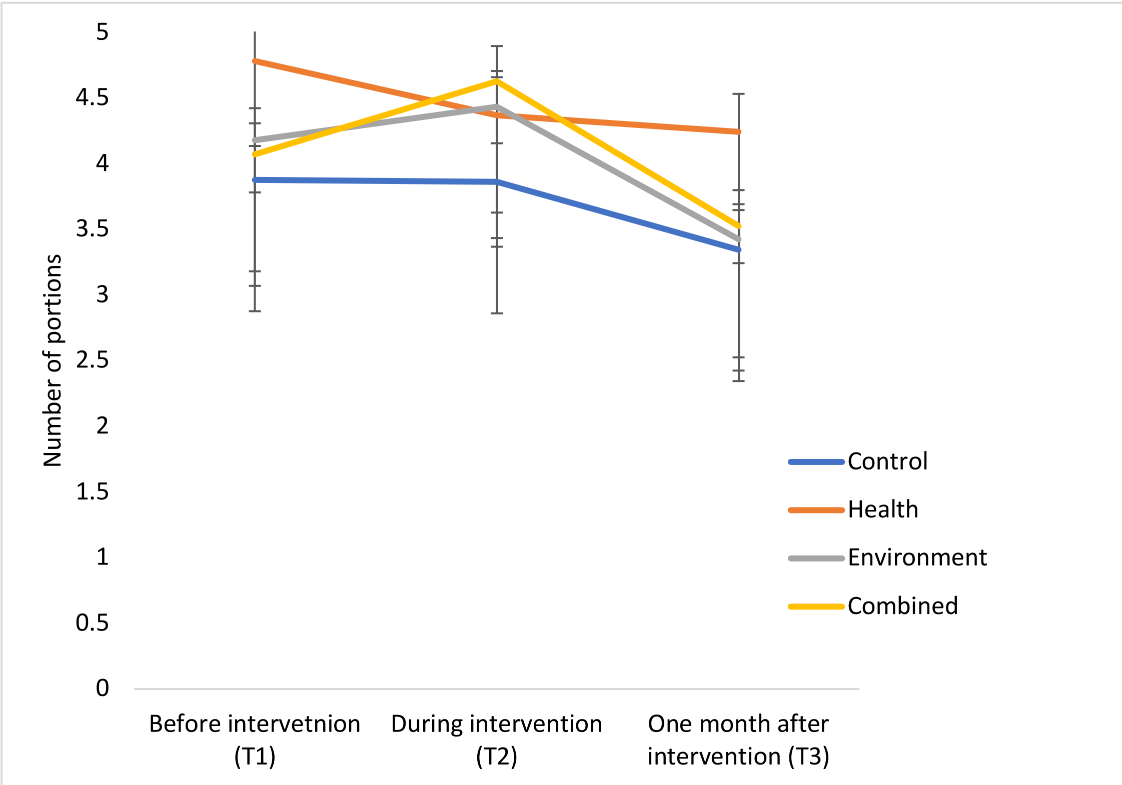

Figure 9. Average white meat consumption across time. Error bars represent standard error +/- mean.

Table 12. Multilevel model regression coefficients for white meat consumption

Predictors	B	SE (B)	df	t	p	95% CI Lower	95% CI Upper
Intercept	3.88	0.26	332.55	15.00	<0.001**	3.37	4.39
Time							
Time 2	-0.02	0.32	345.38	-0.05	0.961	-0.64	0.61
Time 3	-0.53	0.32	324.10	-1.65	0.101	-1.17	0.10
Condition							
Health	0.90	0.36	332.55	2.52	0.012*	0.20	1.61
Environment	0.30	0.35	332.55	0.86	0.391	-0.39	1.00
Combined	0.19	0.35	332.55	0.55	0.583	-0.50	0.88
Interactions							
Time 2 * Health	-0.40	0.44	345.89	-0.90	0.368	-1.27	0.47
Time 2 * Environment	0.27	0.43	344.48	0.63	0.532	-0.58	1.11
Time 2 * Combined	0.57	0.43	344.66	1.34	0.180	-0.27	1.41
Time 3 * Health	-0.01	0.45	324.33	-0.02	0.987	-0.89	0.87
Time 3 * Environment	-0.23	0.43	323.23	-0.522	0.603	-1.08	0.63
Time 3 * Combined	-0.01	0.44	323.58	-0.03	0.978	-0.8	0.84

Note: Time 2 = during intervention, Time 3 = one month after intervention.

$^{*}p < 0.05$, $^{**}p < 0.01$

6.3.1.5 Section summary

The results from the surveys showed that providing information on the environmental, health and combined environmental and health impacts of red and processed meat was effective in significantly reducing participants red and processed meat consumption during the intervention, with some effects shown up to one month later. However, participants in the control condition also reduced their red meat consumption one month after the intervention, suggesting that some aspect of the intervention other than information provision might have resulted in a reduced consumption of red meat at this time. There were no significant differences in the extent to which participants in the environment, health and combined conditions reduced their consumption of red and processed meat. However, only participants in the combined condition continued to reduce their processed meat consumption one month after the intervention. Participants in the combined condition also reduced their red and processed meat consumption significantly more than control participants one month after the intervention, while this was not the case for those in the environment or health conditions. Thus, the combined messages appeared to have some longer lasting effects on reducing participants' processed meat consumption, compared to the health and environmental messages. Participants in the health condition appeared to consume more white meat compared to participants in the control condition throughout the entire study duration. However, the results did not show any evidence to support that white meat was used as a replacement for red and processed meat by participants during the intervention or one month later.

6.3.2 Results from the food diaries

6.3.2.1 Participant attrition rates

The number of participants who completed the food diaries during each day of the two-week intervention period is shown in Table 13. The Table shows that the number of participants who completed the food diaries decreased each day during the intervention. Similar to past literature (e.g. Lambe et al., 2000), drop-out rates increased over time, with the highest drop-out rate shown for day 14, where 64 fewer participants completed the food diary compared to the previous day.

Table 13. Number of participants completing the food diary during the two-week messaging intervention

	Day													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Control	N = 72	N = 64	N = 63	N = 61	N = 60	N = 60	N = 57	N = 57	N = 54	N = 52	N = 48	N = 41	N = 33	N = 17
Health	N = 76	N = 67	N = 62	N = 59	N = 58	N = 58	N = 54	N = 52	N = 49	N = 48	N = 44	N = 39	N = 29	N = 15
Environment	N = 81	N = 74	N = 70	N = 68	N = 68	N = 65	N = 65	N = 65	N = 62	N = 60	N = 58	N = 53	N = 50	N = 33
Combined	N = 82	N = 74	N = 74	N = 69	N = 69	N = 68	N = 67	N = 67	N = 63	N = 63	N = 60	N = 53	N = 46	N = 29
Total	N = 311	N = 279	N = 269	N = 257	N = 255	N = 251	N = 243	N = 241	N = 228	N = 223	N = 210	N = 186	N = 158	N = 94

6.3.2.2 Overall consumption

The average daily proportion of participants who consumed at least one portion of red/processed meat, red meat, processed meat, alternatives to red and processed meat, white meat, fish and plant-based alternatives (each of the outcome variables, see section 6.2.2.1), during the two-week intervention period is summarised in Figure 10. Interestingly, the Figure indicates that a greater proportion of participants consumed alternatives to red and processed meat, compared to the proportion of those who consumed red/processed meat. Observing the different alternatives to red and processed meat shows that a greater proportion of participants consumed white meat, with fewer participants consuming fish and plant-based alternatives. The figure also shows a lower proportion of participants in the control condition who consumed alternatives to red/processed meat, as well as white meat, compared to participants in the other conditions. Observing red and processed meat separately shows that a similar proportion of participants consumed red and processed meat respectively. The Figure shows some variation across conditions, where a lower proportion of participants in the health and environment conditions consumed red/processed meat compared to those in the control condition. On the other hand, the proportion of participants in the combined condition who consumed red/processed meat was similar to that of the control condition. Participants' consumption of each food group during the two-week intervention period is explored in more detail below.

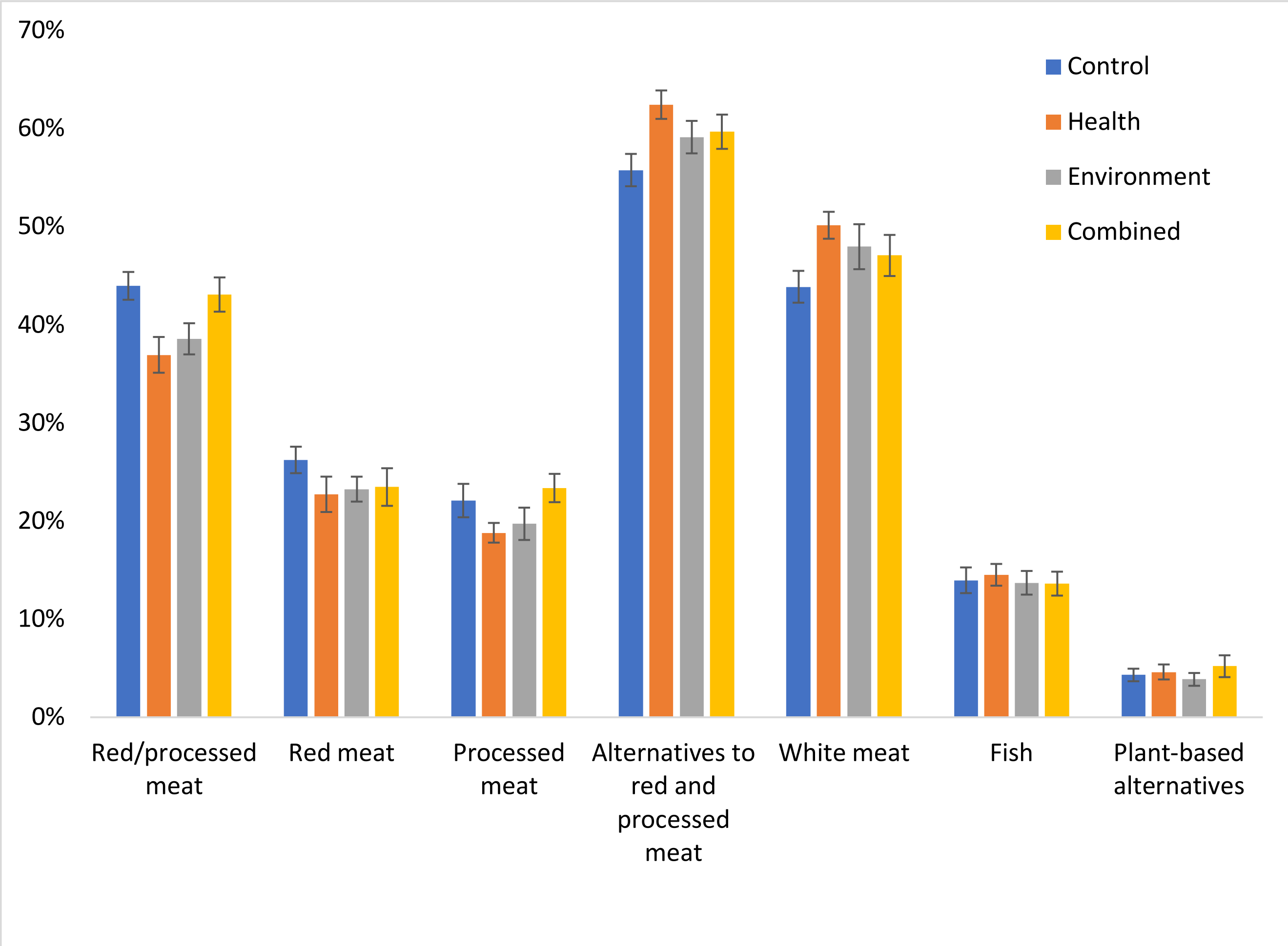

Figure 10. The daily average proportion of participants who consumed red and processed meat as well as potential replacement foods during the two-week intervention period. Error bars represent standard error +/- mean.

Note. Alternatives to red and processed meat was comprised from white meat, fish and plant-based alternatives.

6.3.2.3 Grouped red/processed meat

The proportion of participants who consumed red/processed meat during each day of the intervention is summarised in Figure 11. The Figure shows some variation in the proportion of participants who consumed red/processed meat across each day of the intervention. The Figure shows that a lower proportion of participants consumed red/processed meat in the health condition during the first week of the intervention compared to the other conditions. A similar proportion of participants in the different conditions consumed red/processed meat towards the end of the intervention.

The results from the time-series analysis are summarised in Table 14. As shown by the Table, there was no significant main effect of time when controlling for the effects of condition. This means that the day of the intervention did not have an effect on whether or not participants consumed red/processed meat. A significant main effect of condition was found, where participants in the health condition were significantly less likely to consume red/processed meat compared to participants in the control condition, when controlling for the effect of time (OR = 0.50, 95% CI = 0.32, 0.79). There was no significant interaction between time and the health condition, meaning participants in the health condition were consistently less likely to consume red/processed meat than participants in the control condition, each day of the two-week intervention. There were no significant main effects of the environment or combined conditions on red/processed meat consumption when controlling for the effects of time. Thus, participants in the environment and combined conditions were not significantly less likely to consume red/processed meat compared to participants in the control condition. There were no interaction effects between time and the environment or combined conditions, meaning the likelihood that participants in these conditions consumed red/processed meat remained stable over time. Overall, these results indicate that participants who received information on the health impacts of red and processed meat were significantly less likely to eat red/processed meat during the two-week intervention compared to control participants, while providing information on the environmental impacts, or the combined environmental and health impacts of red and processed meat, did not appear to have any effect.

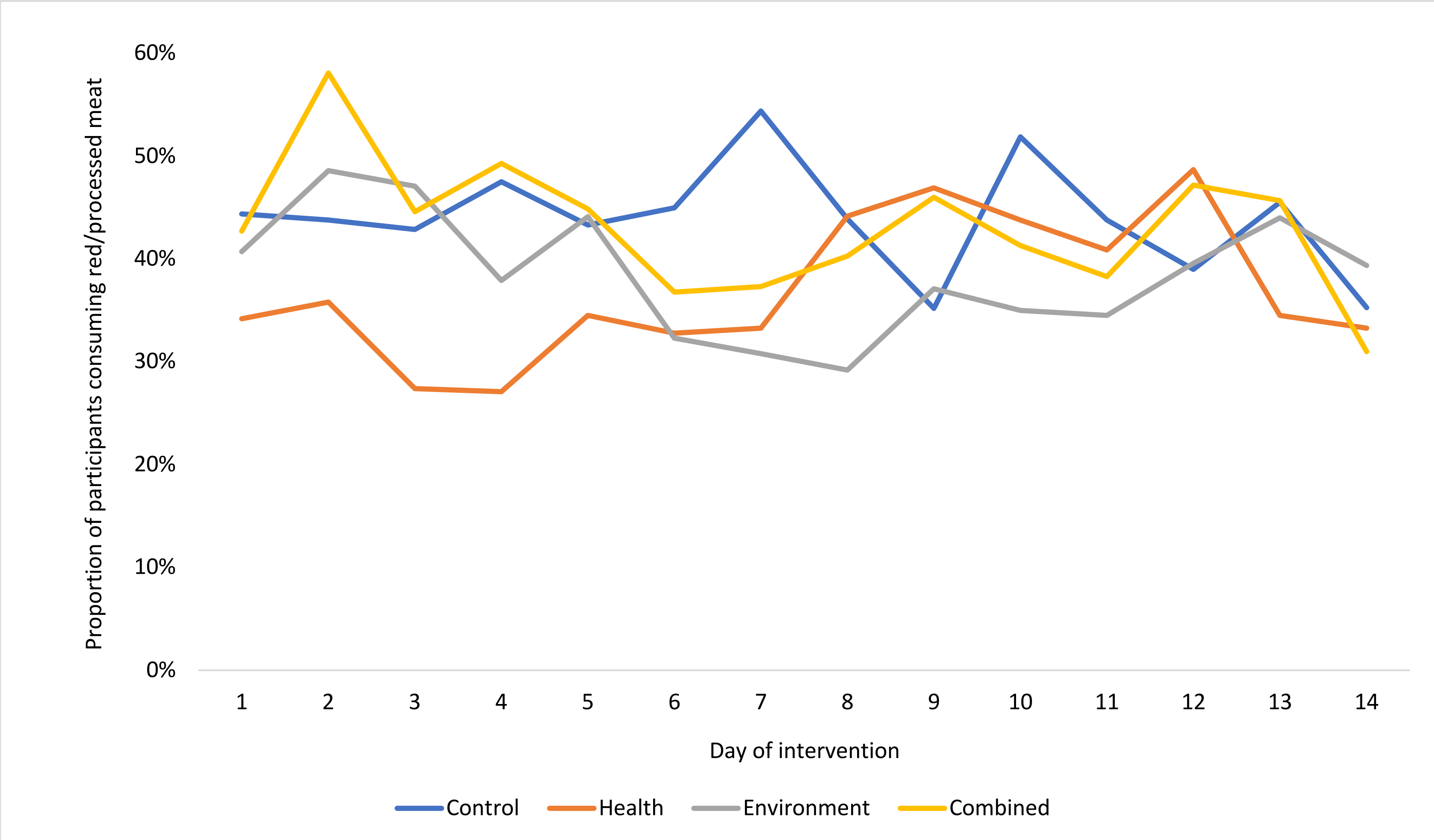

Figure 11. Proportion of participants who consumed red/processed meat each day of the intervention.

Table 14. Binomial time-series regression coefficients with confidence intervals and odds ratios for red/processed meat consumption

	B	SE (B)	OR	95% CI	
				Lower	Upper
Day	-0.00	0.02	1.00	0.96	1.04
Health	-0.69^{**}	0.23	0.50	0.32	0.79
Environment	-0.09	0.23	0.91	0.58	1.43
Combined	0.12	0.22	1.13	0.73	1.75
Day*Health	0.05	0.03	1.05	0.99	1.11
Day*environment	-0.03	0.03	0.98	0.93	1.03
Day*combined	-0.03	0.03	0.97	0.92	1.03

Note: $^{*}p < 0.05$, $^{**}\ p < 0.01$

6.3.2.4 Red meat

The proportion of participants who consumed red meat each day of the intervention is summarised in Figure 12. The Figure shows some variation in the proportion of participants who consumed red meat during each day of the intervention. The Figure also shows that a lower proportion of participants in the combined condition consumed red meat towards the end of the intervention relative to the start.

The results from the time-series analysis are summarised in Table 15. As shown by the Table, there was no significant main effect of time on participants' red meat consumption. Thus, the day of the intervention did not have an effect on whether participants consumed red meat. However, a significant effect of condition was found, where participants in the health condition were significantly less likely to eat red meat compared to participants in the control condition (OR = 0.52, 95% CI = 0.49, 0.55). There was no interaction between time and the health condition, indicating that this pattern of results was consistent across each day of the intervention. There was no significant main effect of the environment or combined conditions on red meat consumption and there were no significant interactions between time and the environment or combined conditions. Thus, the results show that participants who received information on the health impacts of red and processed meat were significantly less likely to eat red meat during the two-week intervention compared to control participants, while providing information on the environmental impacts, or the combined environmental and health impacts of red and processed meat, did not appear to have any effect.

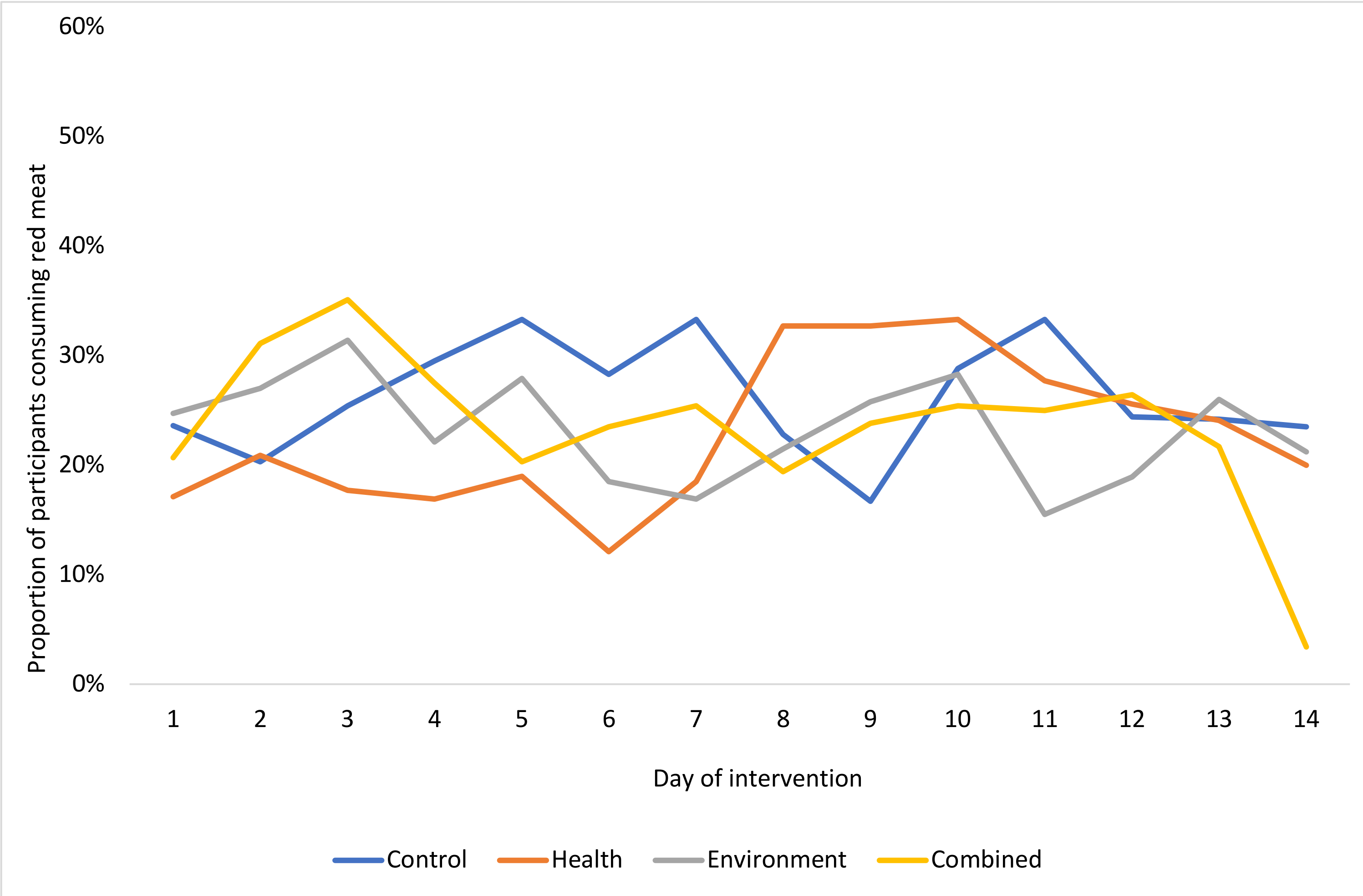

Figure 12. Proportion of participants who consumed red meat each day of the intervention.

Table 15. Binomial time-series regression coefficients with confidence intervals and odds ratios for red meat consumption

	B	SE (B)	OR	95% CI	
				Lower	Upper
Day	0.00	0.02	1.00	0.96	1.05
Health	-0.66 **	0.03	0.52	0.49	0.55
Environment	0.03	0.25	1.03	0.63	1.68
Combined	0.14	0.24	1.15	0.71	1.84
Day*health	0.06	0.03	.1.06	1.00	1.13
Day*environment	-0.03	0.03	0.97	0.91	1.03
Day*combined	-0.04	0.03	0.97	0.91	1.03

Note: $^{*}p < 0.05$, $^{**}p < 0.01$

6.3.2.5 Processed meat

The proportion of participants who consumed processed meat each day of the intervention is summarised in Figure 13. The Figure shows some variation in the proportion of participants who consumed processed meat across each day of the intervention. The Figure also shows that a lower proportion of participants in the environment and health conditions consumed processed meat during the middle portion of the intervention (days 6-11) compared to participants in the control condition.

The results from the time-series analysis are summarised in Table 16. As shown by the Table, there was no significant main effect of time on processed meat consumption. Thus, the day of the intervention did not have an effect on whether or not participants consumed processed meat. There was however a significant effect of condition, where participants in both the environment (OR = 0.75, 95% CI = 0.71, 0.79) and health (OR = 0.66, 95% CI = 0.62, 0.70) conditions were significantly less likely to eat processed meat during the intervention compared to participants in the control condition. There was no interaction between time and the environment or health conditions, meaning participants in these conditions were consistently less likely to eat processed meat than control participants across each day of the two-week intervention. There was no significant effect of the combined condition on processed meat consumption and no significant interaction between time and the combined condition. These findings show that participants who received information on either the environmental or health impacts of red and processed meat were significantly less likely to eat processed meat compared to participants in the control condition, while providing information on the combined environmental and health impacts of red and processed meat did not appear to have any significant effect.

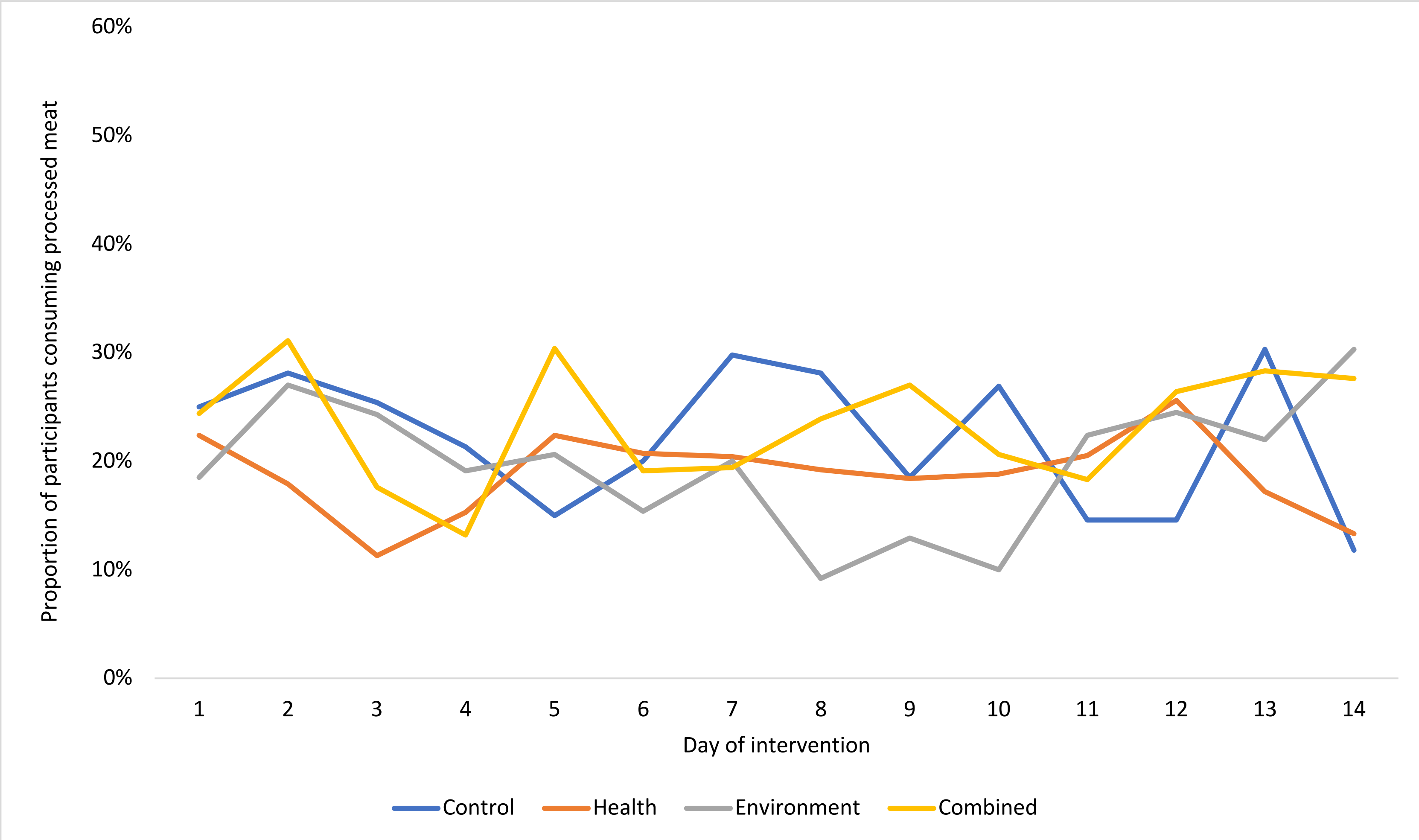

Figure 13. Proportion of participants who consumed processed meat each day of the intervention.

Table 16. Binomial time-series regression coefficients with confidence intervals and odds ratios for processed meat consumption

	B	SE (B)	OR	95% CI	
				Lower	Upper
Day	-0.02	0.03	0.98	0.94	1.03
Health	-0.42 **	0.03	0.66	0.62	0.70
Environment	-0.29 **	0.03	0.75	0.71	0.79
Combined	-0.07	0.29	0.94	0.53	1.66
Day*health	0.01	0.04	1.01	0.94	1.09
Day*environment	0.01	0.03	1.01	0.95	1.08
Day*combined	0.01	0.04	1.01	0.94	1.08

Note: $^{*}p < 0.05$, $^{**}p < 0.01$

6.3.2.6 Grouped alternatives to red and processed meat

The proportion of participants who consumed alternatives to red and processed meat (white meat, fish, and plant-based alternatives) is summarised in Figure 14. The Figure shows variation in the proportion of participants who consumed alternatives to red and processed meat across each day of the intervention. The Figure also shows that a higher proportion of participants in the health condition consumed alternatives to red and processed meat compared to participants in the control condition, throughout each day of the intervention.

The results from the time-series analysis are summarised in Table 17. As shown by the Table, there was no significant main effect of time. Thus, the day of the intervention did not have an effect on the likelihood of participants consuming alternatives to red and processed meat. There was no significant main effect of the environment, health or combined conditions, meaning participants in these conditions were not significantly more likely to consume alternatives to red and processed meat compared to participants in the control condition. Thus although a greater proportion of participants in the health condition appeared to consume alternatives to red and processed meat compared to control participants, this apparent trend was not statistically significant. There were also no significant interactions between time and the environment, health or combined conditions, meaning the consumption of alternatives to red and processed meat was stable over time for participants in these conditions. Overall, these results show that providing information on the environmental, health or the combined environmental and health impacts of red and processed meat, did not have any impact on the likelihood of participants consuming alternatives to red and processed meat, compared to participants in the control condition.

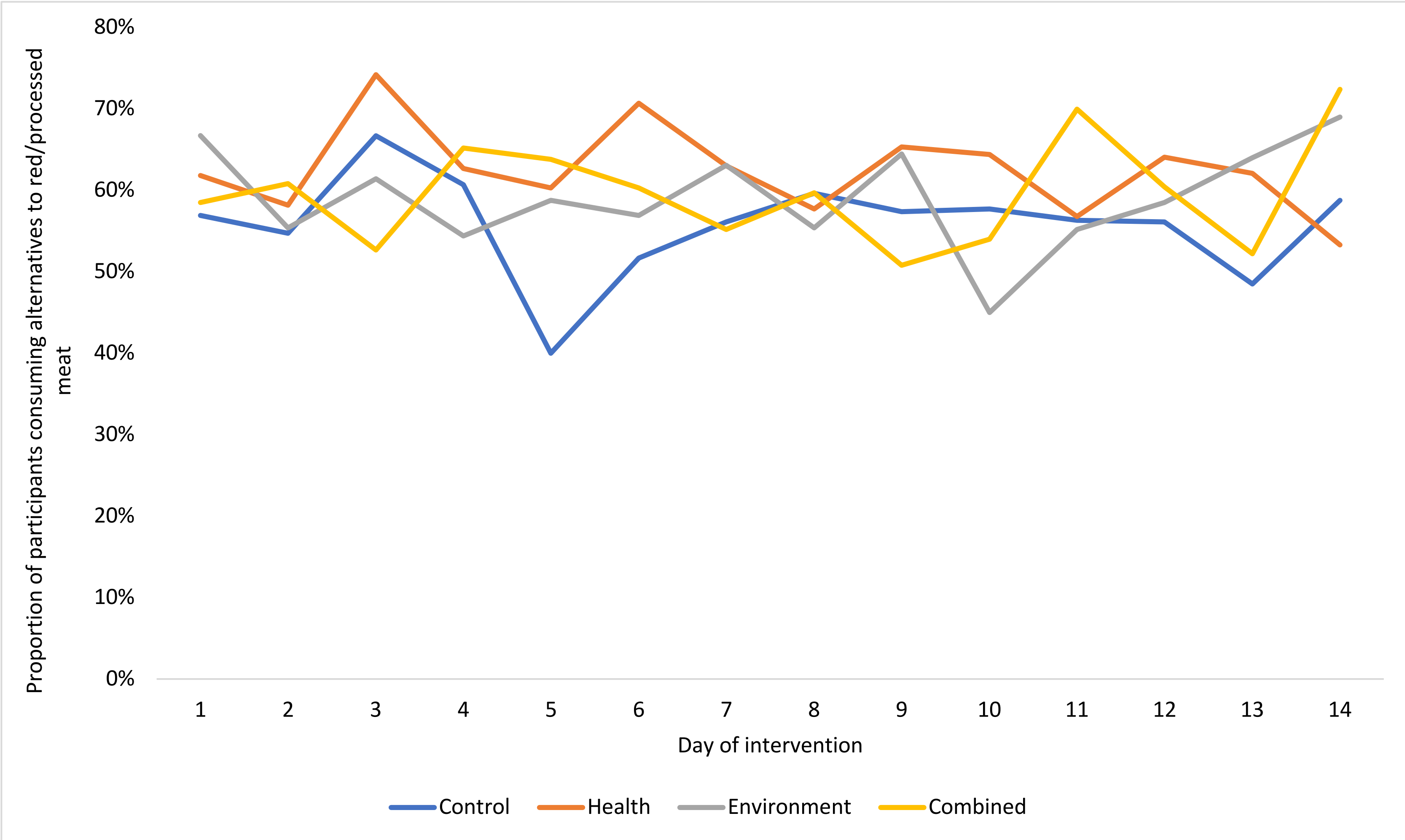

Figure 14. Proportion of participants who consumed alternatives to red and processed meat each day of the intervention.

Table 17. Binomial time series regression coefficients with confidence intervals and odds ratios for consumption of alternatives to red and processed meat

	B	SE (B)	OR	95% CI	
				Lower	Upper
Day	-0.01	0.02	0.99	0.95	1.04
Health	0.36	0.24	1.43	0.89	2.29
Environment	0.11	0.24	1.12	0.71	1.78
Combined	0.09	0.23	1.09	0.69	1.73
Day*health	-0.01	0.03	0.99	0.94	1.05
Day*environment	0.00	0.03	1.00	0.95	1.06
Day*combined	0.01	0.03	1.01	0.96	1.07

6.3.2.7 White meat

The proportion of participants who consumed white meat each day of the two-week intervention is summarised in Figure 15. The Figure shows some variation in the proportion of participants who consumed white meat across the different conditions for each day of the intervention. The Figure also shows that a greater proportion of participants in the combined and environment conditions consumed white meat at the end of the intervention relative to the start.

The results from the time-series analysis are summarised in Table 18. As shown by the Table, there was no significant main effect of time. Thus, the day of the intervention did not have an effect on the likelihood of participants consuming white meat. There was also no significant main effect of condition, meaning participants in the environment, health and combined conditions were not significantly more likely to consume white meat compared to participants in the control condition. There were no significant interactions between time and the environment, health or combined conditions, meaning the consumption of white meat was stable over time, across conditions. Overall, these results suggest that the intervention had no effect on participants' white meat consumption.

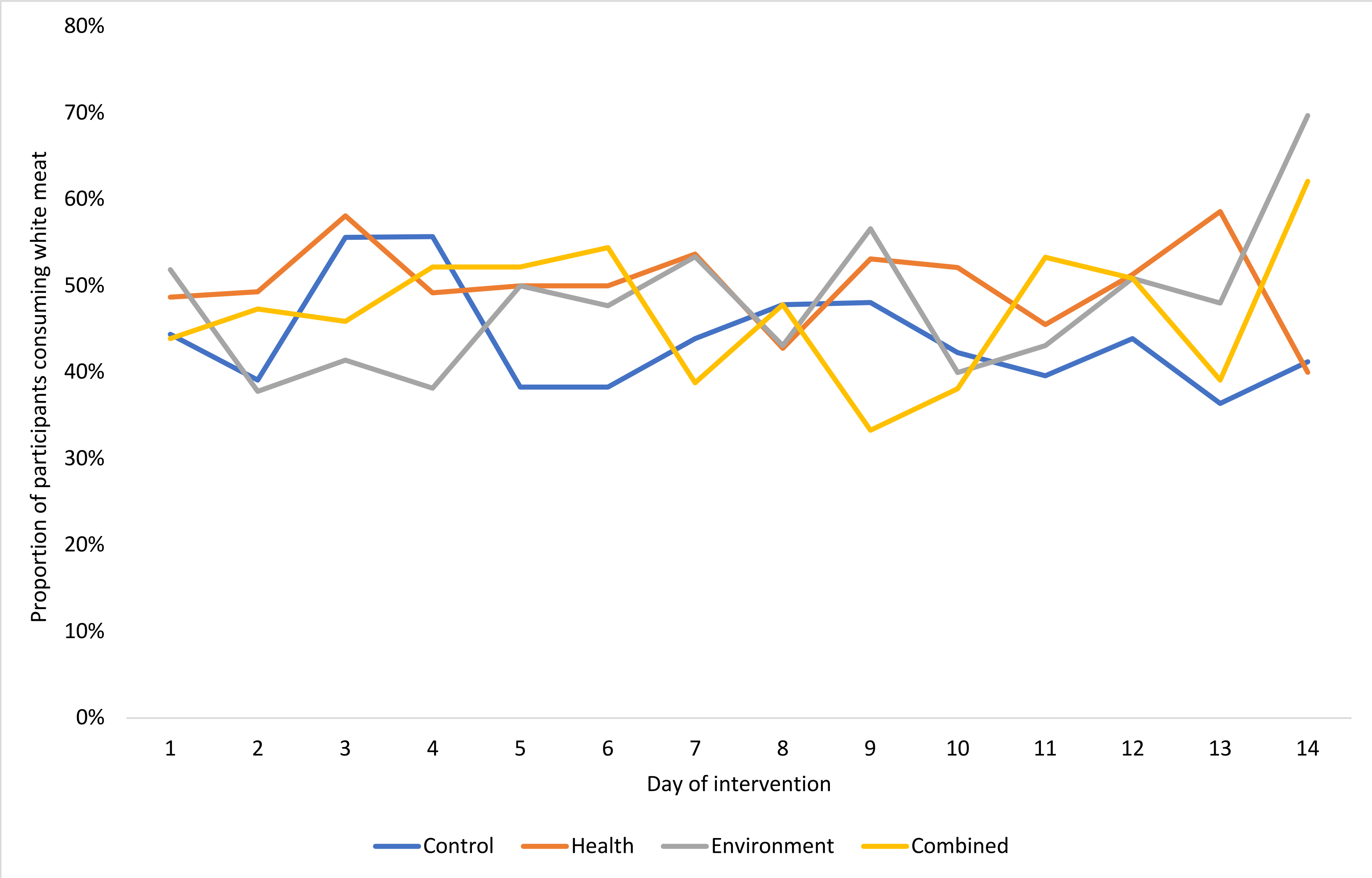

Figure 15. Proportion of participants who consumed white meat each day of the intervention.

Table 18. Binomial time series regression coefficients with confidence intervals and odds ratios for white meat consumption

	B	SE (B)	OR	95% CI	
				Lower	Upper
Day	-0.02	0.02	0.98	0.94	1.02
Health	0.14	0.24	1.15	0.72	1.82
Environment	-0.23	0.23	0.80	0.51	1.25
Combined	-0.02	0.24	0.98	0.61	1.56
Day*health	0.02	0.03	1.02	0.96	1.08
Day*environment	0.05	0.03	1.05	1.00	1.11
Day*combined	0.02	0.03	1.02	0.97	1.08

6.3.2.8 Fish

The proportion of participants who consumed fish each day of the intervention is summarised in Figure 16. The Figure shows that few participants consumed fish during the intervention period, with little variation across the different conditions each day of the intervention and with little variation over time.

The results from the time-series analysis are summarised in Table 19. As shown by the Table, there was no significant main effect of time, meaning the day of the intervention did not have an effect on the likelihood of participants consuming fish. However, there was a significant effect of condition, where participants in the health condition were significantly less likely to eat fish compared to participants in the control condition (OR = 0.93, 95% CI = 0.87, 1.00). There was no interaction between time and the health condition, meaning this pattern of results was consistent throughout the duration of the two-week intervention period. There was no significant effect of the environment or combined condition on participants' consumption of fish, and there were no interaction effects between time and the environment and combined conditions, meaning the consumption of fish was stable over time, across the conditions. Overall, these results show that participants who received information on the health impacts of red and processed meat were less likely to consume fish compared to participants in the control condition, whereas providing information on the environmental, and on the combined environmental and health impacts of red and processed meat, did not have any significant effect.

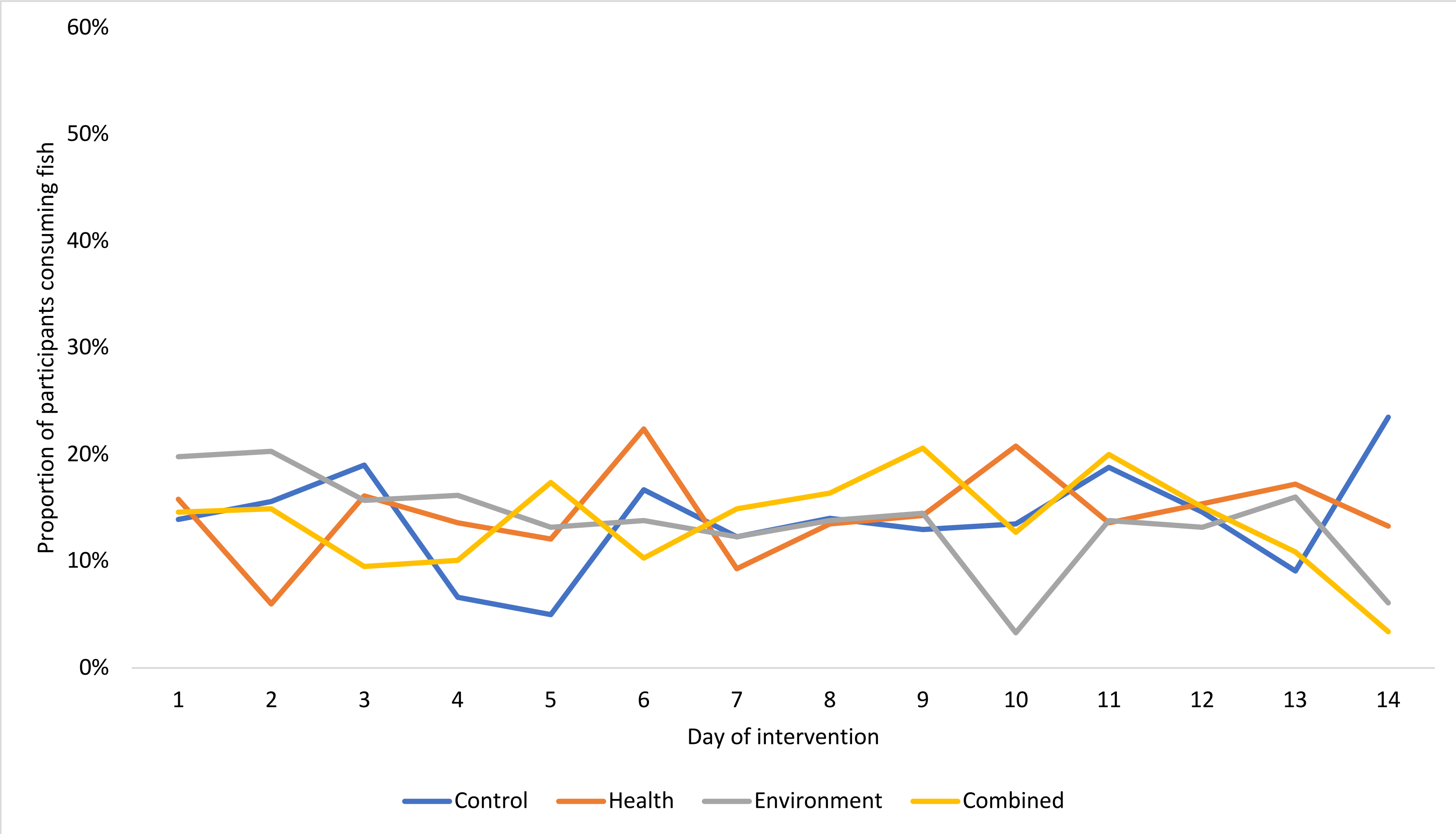

Figure 16. Proportion of participants who consumed fish each day of the intervention.

Table 19. Binomial time series regression coefficients with confidence intervals and odds ratios for fish consumption

	B	SE (B)	OR	95% CI	
				Lower	Upper
Day	0.01	0.03	1.01	0.95	1.07
Health	-0.07 *	0.03	0.93	0.87	1.00
Environment	0.51	0.32	1.66	0.89	3.11
Combined	0.05	0.40	1.05	0.57	1.92
Day*health	0.02	0.04	1.02	0.94	1.11
Day*environment	-0.07	0.04	0.93	0.86	1.01
Day*combined	-0.00	0.04	1.00	0.92	1.08

Note: $^{*}p < 0.05$

6.3.2.9 Plant-based meat alternatives

The proportion of participants who consumed plant-based meat alternatives each day of the intervention is summarised in Figure 17. The Figure shows that few participants consumed plant-based alternatives throughout the intervention, with little variation across conditions and with little variation over time. However, the Figure shows a slight increase in the proportion of participants in the combined condition who consumed plant-based alternatives at the end of the intervention relative to the start.

The results from the time-series analysis are summarised in Table 20. As shown by the Table, there was no significant main effect of time, meaning the day of the intervention did not influence upon the likelihood of participants consuming plant-based alternatives. There was also no significant main effect of condition, meaning participants in the environment, health and combined conditions were not more likely to consume plant-based alternatives compared to participants in the control condition. There were no significant interaction effects between time and any of the messaging conditions, meaning the consumption of plant-based alternatives was stable over time and across each of the conditions. Overall, these results indicate that the intervention did not have any effect participants' consumption of plant-based alternatives during the two-week intervention.

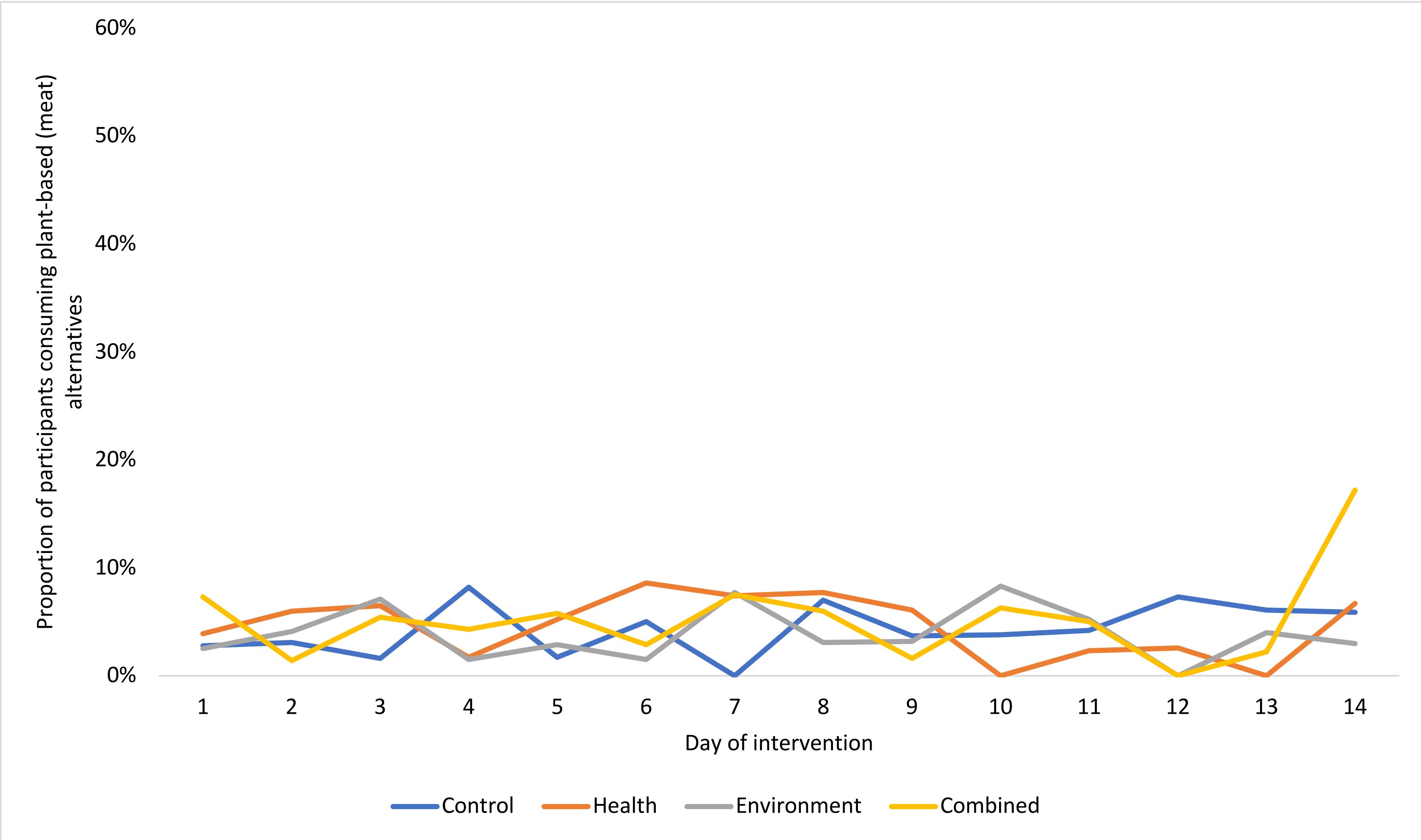

Figure 17. Proportion of participants who consumed plant-based alternatives each day of the intervention.

Table 20. Binomial time series regression coefficients with confidence intervals and odds ratios for consumption of plant-based alternatives

	B	SE (B)	OR	95% CI	
				Lower	Upper
Day	0.07	0.05	1.07	0.97	1.18
Health	0.94	0.59	2.56	0.80	8.16
Environment	0.36	0.58	1.43	0.46	4.47
Combined	0.58	0.58	1.79	0.57	5.58
Day*health	-0.11	0.07	0.90	0.78	1.03
Day*environment	-0.06	0.07	0.94	0.83	1.08
Day*combined	-0.04	0.07	0.96	0.84	1.09

6.3.2.10 Section summary

The results from the food diaries showed that during each day of the two-week intervention, participants in the health condition were significantly less likely to consume red meat, and participants in both the health and environment conditions were significantly less likely to consume processed meat, compared to participants in the control condition. There were no significant effects shown for participants in the combined condition. There was no evidence to suggest that participants in the messaging conditions were more likely to consume any of the potential replacements for red and processed meat; white meat, fish or plant-based alternatives, compared to participants in the control condition. On the other hand, participants in the health condition were significantly less likely than control participants to consume fish throughout the two-week intervention.

6.4 Chapter summary and conclusions

6.4.1 General summary

This chapter reports on the results from the randomised messaging intervention, which aimed to investigate the effect of providing information on the environmental, health and combined environmental and health impacts of red and processed meat, on reducing participants’ red and processed meat consumption. This chapter also aimed to investigate whether white meat, fish and plant-based meat alternatives might be used by participants to replace red and processed meat in their diet. Surveys were used to investigate differences in the amount of red, processed, and white meat consumed by participants during the two-week intervention and one month later, compared to baseline. Food diaries were used to investigate participants’ consumption of red and processed meat, as well as potential meat replacements: white meat, fish and plant-based alternatives, during each day of the two-week intervention. As participants consumed few portions of these foods during each day of the two-week intervention, the diaries were used to compare whether or not each of these foods were consumed, rather than comparing differences in the number of portions, during each day of the intervention (see section 6.2.2.2).

The survey results showed that participants in the environment, health and combined conditions significantly reduced their red and processed meat consumption during the two-week intervention compared to baseline and compared to participants in the control condition, who showed no change in their consumption. This pattern of results was found when red and processed meat was assessed in combination and separately. These findings are consistent with recent literature, which has also demonstrated that providing health messages (e.g. Bertolotti et al., 2019; Jagers et al., 2017) and to a lesser extent environmental messages (e.g. Graham & Abrahamse, 2017; Stea & Pickering, 2019), and combined messages (e.g. Amiot et al., 2018) can be effective in encouraging a reduced consumption of meat.

The results from the food diaries only partially supported the survey findings. The food diaries showed that only participants in the health condition were significantly less likely to consume red/processed meat compared to participants in the control condition, during each day of the two-week intervention. When the consumption of red and processed meat was assessed separately, the results from the food diaries showed that only participants in the health condition were significantly less likely to consume red meat compared to participants in the control condition, while participants in both the health and environment conditions were significantly less likely to consume processed meat compared to participants in the control condition, during each day of the intervention. Thus, participants in the environment condition were not less likely to consume red meat, and participants in the combined condition were not less likely to consume red or processed meat, compared to participants in the control condition during the intervention.

The discrepancies in the findings from the surveys compared to the findings from the food diaries likely result from differences in the analyses conducted. The surveys were used to assess differences in the number of portions consumed over time, whereas the diaries were used to assess whether or not participants consumed each food during the two-week intervention period (using a binary outcome variable; see section 6.2.2.2). Taken together, these findings show that the health messages were effective in reducing the number of portions of red and processed meat consumed and also in reducing the likelihood of participants consuming red and processed meat during each day of the intervention. Environmental messages were effective in reducing the amount of red and processed meat consumed and in reducing the likelihood of participants consuming processed but not red meat, during each day of the intervention compared to control participants. Combined health and environmental messages were effective in reducing the amount of red and processed meat consumed, but did not reduce the likelihood of participants consuming red and processed meat during each day of the intervention compared to control participants.

These findings indicate that while providing information on the environmental and/or health impacts of meat was successful in reducing the amount of red and processed meat consumed by participants, participants did not eliminate red and processed meat from their diet entirely and in some cases consumed it on as many days during the intervention as participants in the control condition. This supports the findings from the initial qualitative interview study, in which it was found that participants preferred to reduce their meat consumption rather than eliminate meat from their diet entirely (see chapter 4, section 4.2.3). On the other hand, providing information on the health impacts of red and processed meat appeared to be particularly effective in reducing the amount of red and processed meat consumed, as well as the likelihood of participants consuming red and processed meat during the intervention. This supports evidence that focussing on health can be a particularly effective strategy for promoting pro-environmental behaviour and in encouraging a reduced meat consumption (e.g. Amelung et al. 2019; Cordts et al., 2014).

The results from the surveys showed that participants continued to reduce their red and processed meat consumption up to one month after the intervention had ended. For example, all participants, including participants in the control condition, significantly reduced their red meat consumption one month after the intervention compared to baseline. However, only participants in the combined condition significantly reduced their processed meat consumption compared to baseline and compared to participants in the control condition at this time. This adds to the limited existing literature also demonstrating that providing information on the different impacts of meat can have long lasting effects on consumption (e.g. Amiot et al., 2018; Carfora et al., 2019b). However, some aspect of the intervention other than information provision might have contributed to this effect, given that participants in the control condition did not receive any information on the impacts of meat but also reduced their red meat consumption at this time. One explanation is that maintaining the daily food dairy might have led participants to self-monitor their meat consumption, resulting in a reduced meat consumption one month later. This would be in line with past research which has supported the role of self-monitoring in encouraging meat reduction (e.g. Carfora et al., 2017a) and has also demonstrated a similar delayed effect of an intervention containing a self-monitoring aspect on reducing red meat consumption (Amiot et al., 2018). On the other hand, it is possible that participants from the different conditions shared information about the study aims in the delay between the intervention and the month follow-up, which could have led control participants to reduce their consumption as a result of social desirability. This possibility cannot be ruled out, as many participants were studying on the same course and therefore may have been in contact with each other.

The results did not show any significant differences in the extent to which participants in the environment, health and combined conditions reduced their red and processed meat consumption, either during the intervention or one month later compared to baseline. However, the results showed that providing combined information on the environmental and health impacts of red and processed meat had longer lasting effects on reducing participants red and processed meat consumption, compared to when this information was provided in isolation. For example, participants in the combined condition reduced their red/processed meat consumption significantly more than control participants, while this was not the case for those in the health or environment conditions. Furthermore, only participants in the combined condition significantly reduced their processed meat consumption one month after the intervention compared to baseline. This supports previous literature which has demonstrated that pro-environmental behaviour, including meat reduction, can be driven by multiple motives (Jagers et al., 2017). Furthermore, this adds to recent literature demonstrating the use of messages combining different types of information about meat in encouraging participants to reduce their meat consumption (e.g. Amiot et al., 2018).

Interestingly, the food diaries showed that participants were more likely to consume white meat than red or processed meat. This is in line with evidence that the consumption of white meat is higher than that of red and processed meat in the UK (Benson et al., 2019). However, the results did not yield any conclusive evidence regarding whether white meat, fish, or plant-based meat alternatives were used by participants to replace red and processed meat during the intervention. The results from the food diaries showed that participants in the environment, health and combined conditions were not significantly more likely to eat white meat, fish or plant-based alternatives than participants in the control condition during each day of the two-week intervention. This was the case when these foods were assessed in combination and separately. The survey results showed that participants in the environment, health and combined conditions did not significantly increase their white meat consumption during the intervention or one month later compared to baseline, or compared to control participants. Therefore, there was no evidence to suggest that the randomised messaging intervention led to an increased uptake of white meat, fish or plant-based alternatives, as potential replacements for red and processed meat.

However, it is important to note that participants' consumption of fish and plant-based meat alternatives was assessed only during the intervention via the food diaries, meaning participants' consumption of these foods could not be compared from before to during or after the intervention. Therefore, while the results from the food diaries indicate that participants in the different messaging conditions were not more likely to consume these foods compared to control participants, it is not possible to determine whether participants might have increased their consumption of these foods during or after the intervention compared to baseline. This is a limitation of the study design that could be addressed in future research, for example by implementing food diaries throughout the entire study duration (see chapter 8, section 8.5 for further discussion).

In sum, the results demonstrate that providing information on the environmental, health and the combined environmental and health impacts of red and processed meat, was effective in significantly reducing participants' red and processed meat consumption during the intervention compared to baseline and compared to the control group. However, participants did not exclude red and processed meat from their diet entirely and in some cases consumed it on as many days during the intervention as those in the control condition, who did not receive any information on the impacts of meat. This supports that participants preferred to reduce their consumption of meat rather than eliminate it from their diet entirely, reflecting the findings from the interview study. The results further showed that participants significantly reduced their consumption of red and processed meat one month after the intervention had ended, compared to baseline. However, in some cases participants in the control condition also reduced their consumption at this time, suggesting that some aspect of the intervention other than information provision, might have led to this effect. Finally, the results showed that participants in the different messaging conditions did not increase their consumption of white meat during the intervention or one month later compared to baseline, and were no more likely than control participants to consume white meat, fish, or plant-based alternatives during the two-week intervention period. Thus, there was no evidence to suggest that these foods were used as replacements for red and processed meat.

6.4.2 Contributions to the literature

This is the first study to compare the effectiveness of health, environmental and combined health and environmental messages, on reducing red and processed meat consumption in the UK. This is an important contribution to the literature, which has tended to focus on the effectiveness of interventions on changing intentions or willingness to reduce one's meat consumption, rather than investigating changes in consumption (see Harguess et al., 2020). Moreover, other studies have investigated the effects of providing different types of information simultaneously, without separately comparing the effects of different types of information (e.g. Amiot et al., 2018). The results from the current study showed that providing information on the health, environmental and combined (health and environmental) impacts of meat was effective in reducing participants' red and processed meat consumption, with effects lasting up to one month later. This builds on past literature supporting the effects of interventions on changing intentions, by demonstrating that providing information on the different impacts of meat can also be effective in encouraging prolonged changes in behaviour. Moreover, the results support the effectiveness of providing information on the health and environmental impacts of meat both separately and in combination. This adds to emerging literature and demonstrates the utility of using of health, environmental and combined messages to reduce excess meat consumption (e.g. Amiot et al., 2018; Bertolotti et al., 2019; Carfora et al., 2019a, 2019b; Graham & Abrahamse, 2017; Jagers et al., 2017; Stea & Pickering, 2019).

It should be noted that Carfora et al. (2019a) investigated the effects of environmental, health and combined messages on reducing red and processed meat consumption in Italy using the same intervention presented in this thesis, as part of a collaborative project. They found that providing information on either the environmental or health impacts of meat was effective in reducing participants' red and processed meat consumption, while the combined messages had no effect. Thus, while the current findings support that information provision can be effective in changing meat-eating behaviour, it is possible that the effectiveness of different messages, particularly combined messages, might vary across different populations. Future research might therefore consider investigating cross-cultural differences in the motivations for reduced meat consumption across different populations, so that interventions can be tailored accordingly.

The present study also provides a novel contribution to the literature by demonstrating that providing environmental, health and combined messages, can have different effects on the consumption of red and processed meat respectively. Specifically, the results showed that the environmental, health and combined messages were effective in reducing participants' red meat consumption one month after the randomised messaging intervention. On the other hand, only the combined messages were effective in reducing participants' processed meat consumption compared to the control condition at this time. This adds to past literature demonstrating that interventions can have differing impacts on different types of meat. For example, two previous studies found that lifestyle interventions aimed at reducing behavioural risk factors linked to colorectal cancer and encouraging positive lifestyle changes among cancer survivors were effective in reducing processed meat consumption, but not red meat consumption (Hawkes et al., 2009; Hawkes, et al., 2012). On the other hand, the current findings suggest that different types of information might be relevant for encouraging the reduction of different types of meat over a prolonged period of time. Specifically the findings suggest that strategies aimed at reducing processed meat consumption should consider combining different types of information, to encourage longer lasting behaviour change.

Chapter 7: Red and Processed Meat Reduction and Pro-Environmental Behavioural Spillover

7.1 Introduction

The previous chapter showed that participants who received information on the environmental, health and combined environmental and health impacts of meat as part of a randomised messaging intervention, significantly reduced their consumption of red and processed meat during the intervention and one month later. This chapter addresses the final aim of this thesis (see chapter 2, section 2.6), to establish whether this reduced consumption of red and processed meat would be associated with an increased willingness to engage in other untargeted pro-environmental behaviours, as a result of pro-environmental behavioural spillover (see chapter 2, section 2.5). Based on the reviewed literature, this chapter also aims to investigate whether any spillover effects might be attributed to an increased pro-environmental identity and whether behavioural difficulty might increase, and contribution ethic might decrease, the likelihood of spillover occurring following a reduced consumption of red and processed meat.

As with the previous chapters, this chapter is largely exploratory. However, different expectations were made by drawing on existing literature. First, it was expected that a reduced consumption of red and processed meat would be associated with an increased willingness to perform other, untargeted, pro-environmental behaviours, given that several studies have evidenced a tendency for individuals to engage in other pro-environmental behaviours after adopting an initial pro-environmental behaviour (see Nash et al., 2017; Truelove et al., 2014), including meat reduction (Carrico et al., 2018; Verfuerth et al., 2019). Second, it was expected that a reduced red and processed meat consumption would lead to an increased pro-environmental identity, given that previous studies have found an increased pro-environmental identity following interventions aimed at behaviour change, including those encouraging a reduced meat consumption (Verfuerth et al., 2019). Third, it was expected that an increased pro-environmental identity would be associated with an increased willingness to engage in other pro-environmental behaviours, given that previous research has demonstrated pro-environmental identity to be a significant predictor of pro-environmental behaviour over and above past behaviour (e.g. Whitmarsh & O'Neill, 2010). Fourth, it was expected that behavioural difficulty would moderate the hypothesised relationship between red and processed meat reduction and participants' willingness to engage in other pro-environmental behaviours, where the relationship would be stronger for participants who found reducing their red and processed meat consumption to be more difficult. This is based on evidence that an individual might be more likely to consider themselves to be a pro-environmental person if they recently adopted a difficult (rather than easy) or costly (rather than costless) pro-environmental behaviour (Truelove et al., 2014). Fifth, it was expected that contribution ethic would have a moderating effect on the hypothesised relationship between red and processed meat reduction and participants' willingness to engage in other pro-environmental behaviours, where a reduced consumption of red and processed meat would be associated with a decreased willingness to engage in other pro-environmental behaviours for participants who had a strong contribution ethic. This is based on the argument that individuals decline opportunities to engage in pro-environmental behaviours if they feel that they have already 'done their bit' for the environment (Thøgersen & Crompton, 2009). The same patterns of results were expected to emerge from the data collected during the intervention period and one month later.

This chapter will first provide an overview of the different outcome variables and statistical methods used to analyse the data (section 7.2), before reporting the results (section 7.3) and providing a brief summary and conclusion of this chapter, including discussion of the contributions offered by this study (section 7.4).

7.2 Statistical analysis

7.2.1 Outcome variables

7.2.1.1 Behavioural spillover

Participants indicated how often they planned to perform a total of 10 different private and public-sphere pro-environmental behaviours in the next six months (from the time of measurement; see chapter 3, section 3.6.2). Thus, the behavioural spillover measure reflects participants' willingness to perform different pro-environmental behaviours. This measure was taken shortly after the two-week intervention and one month following from this.

7.2.1.2 Change in red and processed meat consumption

Participants were asked to record the number of portions of red and processed meat they had consumed during the *previous week* at three time points: at baseline, shortly after the randomised messaging intervention, and at a one-month follow-up (see chapter 3, section 3.6.2). Thus, the measures reflected the number of portions consumed by participants during one week before the intervention, during the second week of the intervention and four weeks after the intervention. These measures were used to calculate difference scores. The difference in the number of portions of red and processed meat consumed by participants during the second week of the intervention compared to baseline was calculated as an indicator of participants' change in red and processed meat consumption during the intervention. The difference in the number of portions of red and processed meat consumed by participants one month after the intervention compared to baseline was also calculated, as an indicator of participants' change in red and processed consumption one month after the intervention had ended. Difference scores were used given that this chapter is interested in the relationship between behaviour change, specifically red and processed meat reduction, on participants' willingness to engage in other pro-environmental behaviours (see section 7.1).

7.2.1.3 Change in pro-environmental identity

Participants' pro-environmental identity was measured shortly after the two-week intervention and one month later, through scale items in addition to a Venn diagram assessing how much participants perceived themselves to be an environmentally friendly individual (see chapter 3, section 3.6.2). This measure was used to calculate difference scores. The difference in participants' pro-environmental identity measured shortly after the intervention compared to baseline was calculated as an indicator of participants' change in pro-environmental identity at the end of the intervention. The difference in participants' pro-environmental identity measured one month after the intervention compared to baseline was also calculated, as an indicator of participants' change in pro-environmental identity one month after the intervention had ended. Difference scores were used given that this chapter is interested in the effect of an increased pro-environmental identity on participants' willingness to perform other pro-environmental behaviours (see section 7.1).

7.2.1.4 Behavioural difficulty

Behavioural difficulty was measured shortly after the two-week intervention and one month later, through scale items whereby participants indicated the extent to which they found reducing their red and processed meat intake to be difficult (see chapter 3, section 3.6.2).

7.2.1.5 Contribution ethic

Contribution ethic was measured shortly after the intervention and one month later, through semantic scale items which required participants to indicate the extent to which they felt that they had already 'done their bit' to protect the environment (see chapter 3, section 3.6.2).

7.2.2 Statistical analysis

This chapter mainly uses linear regression analyses, given that this chapter focuses on the relationships between different continuous variables. First, linear regressions are conducted with change in red and processed meat consumption as a predictor of participants' willingness to perform each of the different pro-environmental behaviours, to investigate whether the effect of the intervention on reducing participants' red and processed meat consumption would spillover to other untargeted pro-environmental behaviours. Next, a paired samples t-test is used to investigate whether there is a significant increase in participants' pro-environmental identity at the end of the intervention and at the month follow-up compared to baseline, to establish whether the randomised messaging intervention had a significant effect on pro-environmental identity. Linear regressions are then used to investigate whether a reduced consumption of red and processed meat would predict an increased pro-environmental identity and whether an increased pro-environmental identity would predict an increased willingness to perform the different pro-environmental behaviours. Next, hierarchical regression is used to investigate whether behavioural difficulty would moderate the hypothesised relationship between red and processed meat reduction and participants' willingness to engage in other pro-environmental behaviours. This is done by testing the ability of a change in red and processed meat consumption*behavioural difficulty interaction term to predict intentions to perform different pro-environmental behaviours, over and above the independent effects of each variable. Finally, hierarchal regression is used to investigate whether contribution ethic would moderate the hypothesised relationship between red and processed meat reduction and participants' willingness to engage in other pro-environmental behaviours. This is done in a similar way, by testing the ability of a change in red and processed meat consumption*contribution ethic interaction term to predict intentions to perform the different pro-environmental behaviours, over and above the independent effects of each variable.

Participants' willingness to engage in each of the 10 pro-environmental behaviours were assessed separately, to identify which pro-environmental behaviours participants might be more willing to perform as a result of reducing their red and processed meat consumption. This is because little is currently known about whether meat reduction might lead to behavioural spillover, or for which behaviours spillover might occur (see chapter 2, section 2.5). Control participants were excluded from all of the analyses given that these participants were not asked to change their behaviour, while behavioural spillover occurs following behaviour change, through the adoption of an initial pro-environmental behaviour (see chapter 2, section 2.5).

4.2.3 Controlling for multiple comparisons

As noted above, participants' willingness to perform each of the 10 pro-environmental behaviours were assessed independently, both shortly after the two-week intervention period and one month later. Thus, a number of separate statistical tests were computed. For example, an initial 20 regression analyses were conducted to investigate whether change in red and processed meat consumption would predict an increased willingness to perform each of the 10 pro-environmental behaviours measured at the end of the intervention period and one month later. A problem with conducting multiple analyses on the same outcome variables is that the probability of detecting an effect occurring from chance increases with the number of statistical tests conducted (e.g. Andrade, 2019). Fortunately, there are different methods that can be used to correct for this issue. However, the relative benefits and drawbacks of these techniques should be considered. For example, the most commonly used method to correct for multiple comparisons is the Bonferroni correction, where the *p*-value (generally an α of 0.05) is divided by the number of statistical tests conducted. However, this method has been criticised as being overly conservative and for increasing the risk of falsely rejecting hypotheses when they are in fact true (Streiner & Norman, 2011). A less conservative method is the Hochberg method, which uses a step-up procedure to compare the largest *p*-values to an alpha of 0.05 (Hochberg, 1988). However, this approach has been criticised for being too liberal, risking the false acceptance of hypotheses when they are in fact false (Streiner, 2015). For these reasons, the Holm-Bonferroni method was applied to control for the multiple comparisons conducted in this chapter, given that this procedure is viewed as providing a good middle ground between the overly conservative Bonferroni method and the overly liberal Hochberg method (Streiner, 2015). The Holm-Bonferroni method follows a series of sequential steps which calculates adjusted p-values based on the size of the original p-values, and their rank order from smallest to largest. The method uses a sequentially rejective approach so that each original p-value is compared to its adjusted p-value until the first hypothesis is rejected (i.e. the original p-value is not smaller than the corrected value), after which all remaining hypotheses are declared non-significant (see Holm, 1979). In line with the advice of Streiner (2015), this chapter reports both corrected and uncorrected (α = 0.05) p-values for reader interpretation.

7.3 Results

From herein, for clarity and conciseness, T1 is used to denote data collected at baseline prior to the messaging intervention, T2 is used to denote data collected at post-test shortly after the two-week intervention, and T3 is used to denote data collected at the one-month follow-up.

7.3.1 Investigating behavioural spillover

The proportion of participants who were willing to perform each of the different pro-environmental behaviours measured at T2 and T3 are summarised in Figures 18 and 19 respectively. Both Figures show that participants were overall quite willing to perform different private-sphere pro-environmental behaviours (e.g. taking shorter showers) and were much less willing to perform public-sphere pro-environmental behaviours (e.g. volunteering for an environmental group), both at the end of the intervention (T2) and one month later (T3). For example, approximately 50% of participants were not willing to perform either of the public-sphere behaviours, donating or volunteering to an environmental group. On the other hand, more than 80% of participants were willing to perform each of the private-sphere behaviours at least once.

7.3.1.1 Spillover effects at T2

Linear regressions were conducted with change in red and processed meat consumption (T2 – T1) as the independent variable and willingness to engage in each of the pro-environmental behaviours measured at T2, as dependent variables. The results for each regression model are summarised in Table 21. As shown by the Table, there was a marginally significant relationship between change in red and processed meat consumption and participants' willingness to eat less meat and dairy (F (1, 190) = 4.10, p = 0.044, adjusted R^2 = 0.02) when considering the uncorrected p-value, where a reduced consumption of red and processed meat was associated with an increased willingness to eat less meat and dairy. However, this relationship was not significant when applying the Holm-Bonferroni correction. Change in red and processed meat consumption did not significantly predict participants' willingness to perform any other pro-environmental behaviour shortly after the intervention period (all ps > 0.05) when considering uncorrected or Holm-Bonferroni corrected p-values.

7.3.1.2 Spillover effects at T3

Linear regressions were conducted with change in red and processed meat consumption (T3 – T1) as the independent variable and willingness to engage in each of the pro-environmental behaviours measured at T3 as dependent variables. The results for each of the regression models are summarised in Table 22. As shown by the Table, change in red and processed meat consumption significantly predicted participants' willingness to engage in a number of pro-environmental behaviours at T3 when considering the uncorrected p-values. A reduced consumption of red and processed meat significantly predicted an increased willingness to: have shorter showers and infrequent baths (F (1, 182) = 7.44, p = 0.007, adjusted R^2 = 0.03), buy an eco-friendly product (F (1,182) = 9.91, p = 0.002, adjusted R^2 = 0.05), buy a product with less packaging (F (1, 182) = 5.87, p = 0.016, adjusted R^2 = 0.03), buy local rather than imported food (F (1, 182) = 5.90, p = 0.016, adjusted R^2 = 0.03), eat seasonal fruits and vegetables (F (1, 182) = 7.95, p = 0.005, adjusted R^2 = 0.037) and eat less meat and dairy products (F (1, 182) = 5.24, p = 0.023, adjusted R^2 = 0.023). However, these effects were no longer significant when applying the Holm-Bonferroni correction. There was no significant relationship between change in red and processed meat consumption and participants' willingness to buy organic food produce, use public transport rather than drive, or to volunteer or donate to an environmental group, when considering uncorrected or Holm-Bonferroni corrected p-values (all *p*s > 0.05).

7.3.1.3 Section summary

These results do not show any conclusive evidence of pro-environmental behavioural spillover occurring following a reduced consumption of red and processed meat. Considering the uncorrected *p*-values, the results showed limited evidence of behavioural spillover shortly after the intervention, as there was only a marginal effect of reduced red and processed meat consumption on increasing participants' willingness to reduce their consumption of other meat and dairy products. There appeared to be some evidence for spillover one month after the intervention, where a reduced red and processed meat consumption was associated with an increased willingness to perform various other pro-environmental behaviours. However, these findings were no longer significant when controlling for multiple comparisons using Holm-Bonferroni correction, which is problematic considering the risk of Type one error with these analyses. On the other hand, effects found to be significant before Holm-Bonferroni correction can indicate areas of interest for further, more targeted research (see Streiner, 2015). In this case, effects found to be significant before the correction can point towards the potential pro-environmental behaviours for which spillover might be more likely to occur, following a reduced consumption of meat. Although the above findings were not significant after controlling for multiple comparisons, follow-up analyses investigating the potential moderating effects of behavioural difficulty (section 7.3.3) and contribution ethic (section 7.3.4) were carried out for exploratory purposes. This follows the advice from Streiner (2015) who cautions that completely disregarding findings found to be non-significant following correction for multiple comparisons can lead to potentially interesting and useful findings to be overlooked (Streiner, 2015).

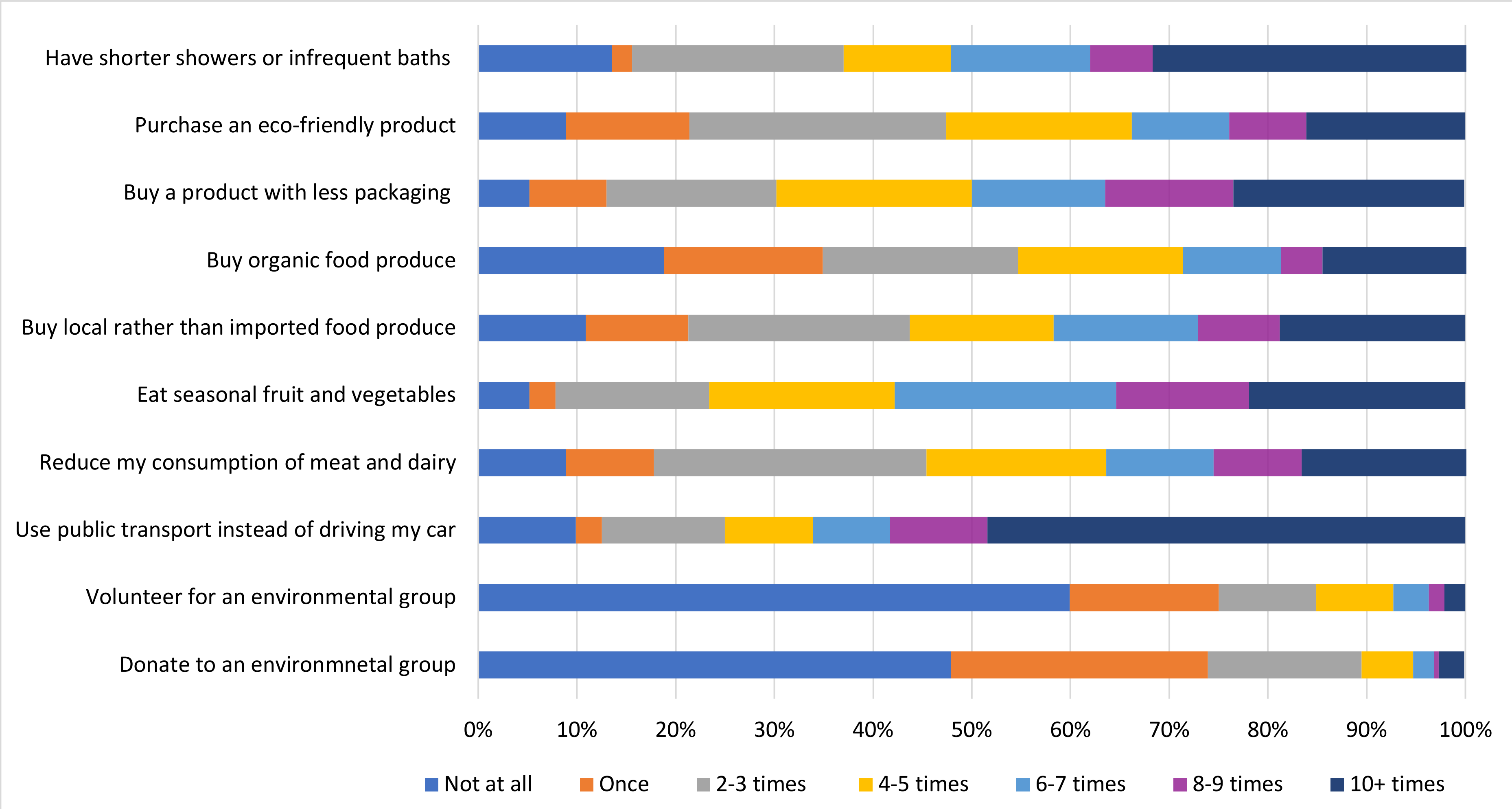

Figure 18. Proportion of participants willing to perform pro-environmental behaviours at T2.

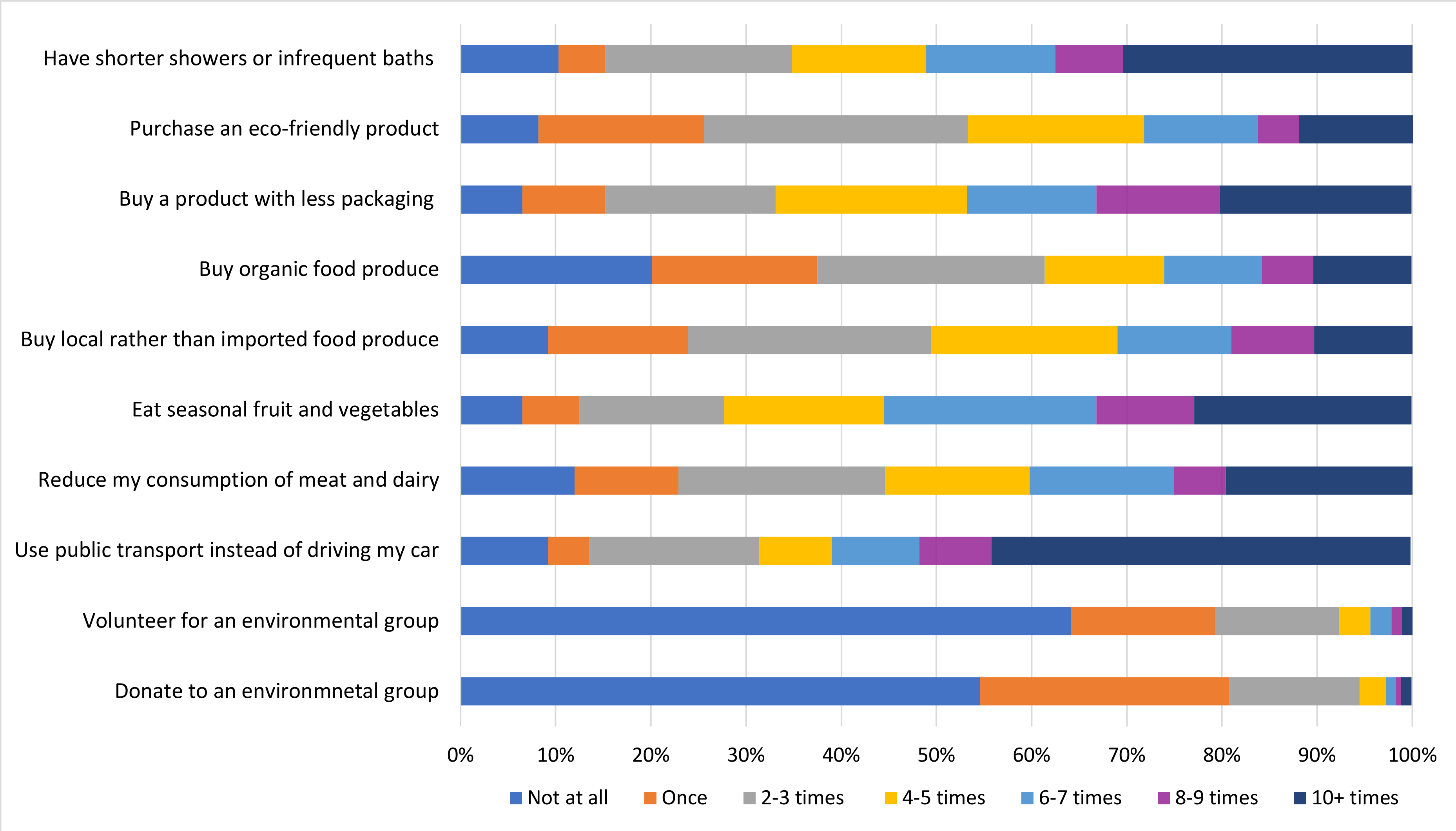

Figure 19. Proportion of participants willing to perform pro-environmental behaviours at T3.

Table 21. Regression parameters of change in red and processed meat consumption (T2 – T1) as a predictor of participants' willingness to perform pro-environmental behaviours at T2

Behaviour	B	SE (B)	β	t	*p*
Have shorter showers or infrequent baths	-0.02	0.04	-0.04	-0.51	0.613
Purchase an eco-friendly product	-0.05	0.03	-0.11	-1.51	0.132
Buy a product with less packaging	-0.01	0.03	-0.02	-0.26	0.792
Buy organic food produce	-0.03	0.03	-0.07	-1.03	0.305
Buy local rather than imported food produce	-0.04	0.03	-0.08	-1.10	0.275
Eat seasonal fruit and vegetables	-0.02	0.03	-0.06	-0.86	0.393
Reduce my consumption of meat and dairy products	-0.06	0.03	-0.15	-2.02	0.044*
Use public transport instead of driving my car	-0.05	0.04	-0.11	-1.53	0.128
Volunteer for an environmental group	0.02	0.02	0.07	0.93	0.355
Donate to an environmental group	0.04	0.02	0.12	1.60	0.111

Note. * $p < 0.05$

Table 22. Regression parameters of change in red and processed meat consumption (T3 – T1) as a predictor of participants' willingness to perform pro-environmental behaviours at T3

Behaviour	B	SE (B)	β	t	*p*
Have shorter showers or infrequent baths	-0.11	0.04	-0.20	-2.73	0.007**
Purchase an eco-friendly product	-0.10	0.03	-0.23	-3.15	0.002**
Buy a product with less packaging	-0.09	0.04	-0.18	-2.42	0.016*
Buy organic food produce	-0.05	0.04	-0.09	-1.24	0.215
Buy local rather than imported food produce	-0.08	0.03	-0.18	-2.43	0.016*
Eat seasonal fruit and vegetables	-0.10	0.03	-0.21	-2.82	0.005**
Reduce my consumption of meat and dairy products	-0.09	0.04	-0.17	-2.29	0.023*
Use public transport instead of driving my car	-0.07	0.04	-0.12	-1.62	0.106
Volunteer for an environmental group	0.01	0.02	0.03	0.37	0.715
Donate to an environmental group	0.00	0.02	0.01	0.08	0.936

Note. * $p < 0.05$, ** $p < 0.01$

7.3.2 Pro-environmental identity as a driver of spillover

7.3.2.1 Change in pro-environmental identity

Participants pro-environmental identity tended to cluster around the midpoint, with little variation at T1 (M = 4.54, SD = 1.04), T2 (M =4.64, SD = 1.00) and T3 (M = 4.69, SD = 1.28). Following this, paired-samples t-tests showed that pro-environmental identity did not significantly increase at T2 (t (247) = 1.88, p = 0.061) or T3 (t (233) =1.578, p = 0.116) compared to T1. Thus, the intervention did not appear to have an effect on participants' pro-environmental identity.

7.3.2.1.2 Red and processed meat reduction as a predictor of pro-environmental identity at T2

A hierarchical multiple regression was conducted to investigate whether change in red and processed meat consumption (T2 – T1) would significantly predict change in pro-environmental identity (T2 – T1) shortly after the intervention. Pro-environmental identity at T1 was included as a co-variate, given that the extent to which a participant is able to increase their identity after the intervention is dependent on their initial pro-environmental identity at baseline. Adding baseline pro-environmental identity (T1) as a co-variate ensures that any change in identity can be attributed to change in red and processed meat consumption. Baseline pro-environmental identity was entered in block 1 and baseline pro-environmental identity with change in red and processed meat consumption (T2 – T1) was entered in block 2, with change in pro-environmental identity (T2 – T1) as the dependent variable. The results are summarised in Table 23. The results showed that the overall model was significant (F (2, 245) = 24.29, p < 0.001, adjusted R^2 = 0.16), when considering both Holm-Bonferroni corrected and uncorrected p-values. Baseline pro-environmental identity explained 17% of variance in block 1 (R^2 = 0.17). However, adding change in red and processed meat consumption in block 2 did not explain any additional variance and did not significantly improve the model (R^2 change = 0.00, F change (1, 245) = 0.13, p = 0.715). In the overall model, change in red and processed meat consumption was not a significant predicter of change in pro-environmental identity when controlling for baseline identity (see Table 23). Thus, there was no evidence that reduced red and processed meat consumption during the intervention lead to an increased pro-environmental identity shortly after the intervention ended.

7.3.2.1.3 Red and processed meat reduction as a predictor of pro-environmental identity at T3

A hierarchical multiple regression was then conducted to test whether there was a significant relationship between change in red and processed meat consumption (T3 – T1) and change in pro-environmental identity (T3 – T1), with pro-environmental identity at T1 entered as a co-variate. As with the above analysis, baseline pro-environmental identity was entered in block 1 and baseline pro-environmental identity with change in red and processed meat consumption (T3 – T1) was entered in block 2, with change in pro-environmental identity (T3 – T1) as the dependent variable. The results are summarised in Table 24. The results showed that the overall model was significant (F (2, 234) = 32.08 p < 0.001, adjusted R^2 = 0.21), when considering both Holm-Bonferroni corrected and uncorrected p-values. Baseline pro-environmental identity explained 22% of variance in block 1 (R^2 = 0.22). However, adding change in red and processed meat consumption did not explain any additional variance and did not significantly improve the model (R^2 change = 0.00, F change (1, 234) = 0.19, p = 0.667). In the overall model, change in red and processed meat consumption was not a significant predictor of change in pro-environmental identity when controlling for baseline identity (see Table 24). Thus, the results did not show any evidence that participants' reduced consumption of red and processed meat one month following the intervention was associated with an increased pro-environmental identity at this time[17].

[17] There was also no significant relationship between change in red and processed meat consumption and change in pro-environmental identity at either time point, when these relationships were tested without the inclusion of baseline pro-environmental identity as a co-variate.

Table 23. Hierarchical multiple regression parameters of change in red and processed meat consumption (T2 – T1) as a predictor of change in pro-environmental identity (T2 – T1)

		B	SE (B)	β	*t*	*p*
Model 1	Baseline pro-environmental identity	-0.29	0.04	-0.41	-6.97	<0.001**
Model 2	Baseline pro-environmental identity	-0.29	0.04	-0.41	-6.96	<0.001**
	Change in red and processed meat consumption	-0.00	0.01	-0.02	-0.37	0.715

Note. * $p < 0.05$, ** $p < 0.01$

Table 24. Hierarchical multiple regression parameters of change in red and processed meat consumption (T3 – T1) as a predictor of change in pro-environmental identity (T3 – T1)

		B	SE (B)	β	*t*	*p*
Model 1	Baseline pro-environmental identity	-0.39	0.05	-0.46	-8.01	<0.001**
Model 2	Baseline pro-environmental identity	-0.39	0.05	-0.46	-8.00	<0.001**
	Change in red and processed meat consumption	0.01	0.01	0.03	0.43	0.667

Note. * $p < 0.05$, ** $p < 0.01$

7.3.2.1.4 Change in pro-environmental identity as a predictor of spillover at T2

Linear regressions were conducted with change in pro-environmental identity (T2 – T1), as a predictor of participants' willingness to perform each of the 10 pro-environmental behaviours measured at T2. The results are summarised in Table 25. As shown by the Table, change in pro-environmental identity did not significantly predict participants' willingness to perform any of the pro-environmental behaviours measured at T2, when considering uncorrected or Holm-Bonferroni corrected p-values (all ps > 0.05).

7.3.2.1.5 Change in pro-environmental identity as a predictor of spillover at T3

Linear regressions were conducted with change in pro-environmental identity (T3 – T1), as a predictor of participants' willingness to perform each of the 10 pro-environmental behaviours measured at T3. The results are summarised in Table 26. As shown by the Table, change in pro-environmental identity did not significantly predict participants' willingness to perform any of the pro-environmental behaviours measured at T3, when considering uncorrected or Holm-Bonferroni corrected p-values (all ps > 0.05).

7.3.2.1.6 Section Summary

Taken together, the results did not show any evidence that the randomised messaging intervention led to an increased pro-environmental identity, or that an increased pro-environmental identity led to an increased willingness to perform additional pro-environmental behaviours, at the end of the intervention or one month later.

Table 25. Regression parameters of change in pro-environmental identity (T2 – T1) as a predictor of participants' willingness to engage in pro-environmental behaviours at T2

	B	SE (B)	β	*t*	*p*
Have shorter showers or infrequent baths	0.27	0.18	0.09	1.48	0.139
Purchase an eco-friendly product	0.19	0.16	0.07	1.16	0.249
Buy a product with less packaging	0.08	0.16	0.03	0.51	0.610
Buy organic food produce	-0.12	0.17	-0.04	-0.69	0.489
Buy local rather than imported food produce	-0.02	0.17	-0.01	-0.13	0.895
Eat seasonal fruit and vegetables	0.10	0.15	0.04	0.68	0.498
Reduce my consumption of meat and dairy products	0.25	0.16	0.10	1.51	0.133
Use public transport instead of driving my car	0.20	0.18	0.07	1.10	0.272
Volunteer for an environmental group	0.09	0.12	0.04	0.68	0.496
Donate to an environmental group	0.13	0.11	0.08	1.17	0.241

Table 26. Regression parameters of change in pro-environmental identity (T3 – T1) as a predictor of participants' willingness to engage in pro-environmental behaviours at T3

	B	SE (B)	β	*t*	*p*
Have shorter showers or infrequent baths	0.18	0.16	0.07	1.11	0.270
Purchase an eco-friendly product	0.02	0.13	0.01	0.15	0.878
Buy a product with less packaging	0.20	0.14	0.09	1.42	0.157
Buy organic food produce	-0.21	0.15	-0.10	-1.45	0.147
Buy local rather than imported food produce	0.15	0.14	0.07	1.10	0.274
Eat seasonal fruit and vegetables	-0.10	0.14	-0.05	-0.69	0.494
Reduce my consumption of meat and dairy products	-0.05	0.15	-0.02	-0.34	0.738
Use public transport instead of driving my car	-0.11	0.17	-0.04	-0.65	0.514
Volunteer for an environmental group	0.07	0.09	0.05	0.74	0.460
Donate to an environmental group	0.05	0.08	0.04	0.66	0.509

7.3.3 The effect of behavioural difficulty on spillover

Analysis was conducted to assess whether behavioural difficulty would moderate the previously established effects of red and processed meat reduction on participants' willingness to engage in the different pro-environmental behaviours at T2 and T3 (see section 7.3.1). Specifically, it was expected that behavioural difficulty would affect the strength of the relationship between red and processed meat reduction and participants' willingness to engage in the different pro-environmental behaviours, where this relationship would be stronger for participants who had found it more difficult to reduce their red and processed meat consumption. This was tested using hierarchical regression analyses with a change in red and processed meat*behavioural difficulty interaction term, to test whether the interaction term would explain significantly more variance in participants' willingness to engage in different pro-environmental behaviours, when controlling for the independent effects of each variable. The variables were mean centred prior to regression analysis to reduce multi-collinearity, given that red and processed meat reduction and behavioural difficulty would be highly correlated with the subsequent interaction term (e.g. see Iacobucci, Schneider, Popovich, & Bakamitsos, 2016).

7.3.3.1 Mean behavioural difficulty

Mean behavioural difficulty scores tended to cluster around the midpoint at T2 ($M = 3.68$, $SD = 1.30$) and at T3 ($M = 3.79$, $SD = 1.36$). This suggests that participants found reducing their red and processed meat consumption to be manageable both shortly after the intervention and one month later.

7.3.3.2 Effects of behavioural difficulty at T2

First, analysis was conducted to test the moderation of behavioural difficulty on the previously established relationship between change in red and processed meat consumption and participants' willingness to eat less meat and dairy, measured at T2 (see section 7.3.1). Change in red and processed meat consumption (T2 – T1) and behavioural difficulty (T2) was entered in block 1 and a change in red and processed meat*behavioural difficulty interaction term was entered in block 2, with willingness to eat less meat and dairy measured at T2 as the dependent variable. The results are summarised in Table 27. As shown by the Table, the overall model was significant (F (3, 188) = 9.18, p < 0.001, adjusted R^2 = 0.11) when considering both Holm-Bonferroni corrected and uncorrected p-values. Change in red and processed meat consumption with behavioural difficulty explained 13% of variance (R^2 = 0.13) in block 1, however adding the interaction term in block 2 did not explain any additional variance and did not significantly improve the model (R^2 change = 0.00, F change (1, 188) = 0.07, p = 0.798). In the final model, behavioural difficulty was the only significant predictor, where an increased behavioural difficulty was associated with a reduced willingness to eat fewer meat and dairy products. Change in red and processed meat and the interaction term were not significant predictors (see Table 27). Thus, there was no evidence to suggest that behavioural difficulty moderated the relationship between red and processed meat reduction and participants' willingness to eat fewer meat and dairy products, although behavioural difficulty was associated with a reduced willingness to perform this behaviour.

Table 27. Hierarchical multiple regression parameters with change in red and processed meat consumption (T2 – T1) and behavioural difficulty (T2) as predictors of participants' willingness to eat less meat and dairy at T2

		B	SE (B)	β	t	*P*
Model 1	Change in red and processed meat	-0.05	0.03	-0.12	-1.75	0.082
	Behavioural difficulty	-0.46	0.10	-0.33	-4.80	<0.001**
Model 2	Change in red and processed meat	-0.05	0.03	-0.12	-1.69	0.092
	Behavioural difficulty	-0.47	0.10	-0.33	-4.77	<0.001**
	Change in red and processed meat*behavioural difficulty	0.01	0.02	-0.02	-0.26	0.798

Note. * $p < 0.05$, ** $p < 0.01$. Variables are mean centered.

7.3.3.3 Effects of behavioural difficulty at T3

Analysis was conducted to test the moderation of behavioural difficulty on the previously established relationships between red and processed meat reduction and participants' willingness to: have shorter showers or infrequent baths, buy an eco-friendly product, buy a product with less packaging, buy local rather than imported food, eat seasonal fruits and vegetables and eat less meat and dairy, measured at T3 (see section 7.3.1). A separate regression model was conducted for each of these pro-environmental behaviours. For each model, change in red and processed meat consumption (T3 – T1) and behavioural difficulty (T3) were entered in block 1 and a change in red and processed meat*behavioural difficulty interaction term was entered in block 2, with participants' willingness to engage in each of the above pro-environmental behaviours as the dependent variables. As in the previous section, the variables were mean-centred. The results for each of the pro-environmental behaviours are summarised in Table 28 and are presented below.

Willingness to have shorter showers or infrequent baths

As shown by Table 28, the model significantly predicted participants' willingness to have shorter showers and infrequent baths (F (3, 180) = 3.52, p = 0.016, adjusted R^2 = 0.04) when considering the uncorrected p-value. Change in red and processed meat consumption with behavioural difficulty in block 1 explained 5% of variance (R^2 = 0.05), while adding the interaction term in block 2 explained only 1% of additional variance and did not significantly improve the model (R^2 change = 0.01, F change (1, 180) = 0.53, p = 0.470). Change in red and processed meat consumption was the only significant predictor in the final model. Behavioural difficulty did not significantly predict participants' willingness to have shorter showers and infrequent baths when controlling for change in red and processed meat consumption. The interaction term was also not a significant predictor when controlling for the independent effects of each variable. Furthermore, the overall model was no longer significant when applying Holm-Bonferroni correction.

Willingness to buy an eco-friendly product

As shown by Table 28, the model significantly predicted participants' willingness to buy an eco-friendly product (F (3, 180) = 3.54, p = 0.016, adjusted R^2 = 0.04) when considering the uncorrected p-value. Change in red and processed meat consumption and behavioural difficulty explained 5% of variance in block 1 (R^2 = 0.05). Adding the interaction term did not explain any additional variance and did not significantly improve the model (R^2 change = 0.00, F change (1, 180) = 0.688, p = 0.408). In the final model, change in red and processed meat consumption was the only significant predictor. Behavioural difficulty did not significantly predict participants' willingness to buy an eco-friendly product when controlling for change in red and processed meat consumption. The interaction term was also not a significant predictor when controlling for the independent effects of each variable. The overall model was no longer significant when applying Holm-Bonferroni correction.

Willingness to buy a product with less packaging

As shown by Table 28, the model significantly predicted participants' willingness to buy a product with less packaging (F (3, 180) = 3.61, p = 0.014, adjusted R^2 = 0.04) when considering the uncorrected p-value. Change in red and processed meat with behavioural difficulty explained 5% of variance in block 1 (R^2 = 0.05). Adding the interaction term in block 2 did not explain any additional variance and did not significantly improve the model (R^2 change = 0.00, F change (1, 180) = 1.48, p = 0.225). In the final model only change in red and processed meat was a significant predictor (see Table 28). Behavioural difficulty did not significantly predict participants' willingness to buy a product with less packaging when controlling for change in red and processed meat consumption and the interaction term was not a significant predictor when controlling for the independent effects of each variable. The overall model was no longer significant when applying Holm-Bonferroni correction.

Willingness to buy local rather than imported produce

As shown by Table 28, the model did not significantly predict participants' willingness to buy local rather than imported produce (F (3, 180) = 2.14, p = 0.097, adjusted R^2 = 0.02), when considering the uncorrected or Holm-Bonferroni corrected *p*-value. Change in red and processed meat consumption with behavioural difficulty explained 3% of variance in block 1 (R^2 = 0.03). Adding the interaction term did not explain any additional variance and did not significantly improve the model (R^2 change = 0.00, *F* change (1, 180) = 0.01, *p* = 0.877). Change in red and processed meat consumption was the only significant predictor in the overall model (see Table 28). Behavioural difficulty did not significantly predict participants' willingness to buy local rather than imported produce when controlling for change in red and processed meat consumption and the interaction term was not a significant predictor when controlling for the independent effects of each variable.

Willingness to eat seasonal fruits and vegetables

The model significantly predicted participants' willingness to eat seasonal fruits and vegetables (*F* (3, 180) = 2.98, *p* = 0.033, adjusted R^2 = 0.03) when considering the uncorrected *p*-value. Change in red and processed meat consumption with behavioural difficulty explained 5% of variance in block 1 (R^2 = 0.05). Adding the interaction term did not explain any additional variance and did not significantly improve the model (R^2 change = 0.00, *F* change (1, 180) = 0.22, *p* = 0.644). In the final model, the only significant predictor was change in red and processed meat (see Table 28). Behavioural difficulty did not significantly predict participants' willingness to eat seasonal produce when controlling for change in red and processed meat consumption. The interaction term was also not a significant predictor when controlling for the independent effects of each variable. The overall model was no longer significant when applying Holm-Bonferroni correction.

Willingness to eat less meat and dairy

As shown by Table 28, the model significantly predicted participants' willingness to eat less meat and dairy (*F* (3, 180) = 13.58, *p* < 0.001, adjusted R^2 = 0.17), when considering both the uncorrected and Holm-Bonferroni corrected *p*-value. Change in red and processed meat consumption with behavioural difficulty explained 18% of variance in block 1 (R^2 = 0.18). Adding the interaction term explained only an additional 1% of variance and did not significantly improve the model (R^2 change = 0.01, *F* change (1, 180) = 2.02, *p* = 0.157). In the final model, both change in red and processed meat consumption and behavioural difficulty were significant predictors, where a reduced consumption of red and processed meat, and an increased behavioural difficulty, predicted a decreased willingness to eat less meat and dairy. However, the interaction term was not a significant predictor when controlling for the independent effects of each variable.

7.3.3.4 Section Summary

Overall, the results showed that behavioural difficulty was associated with a reduced willingness to eat less meat and dairy at the end of the two-week intervention and at the one-month follow-up, even when controlling for multiple comparisons. However, behavioural difficulty did not significantly impact upon the strength of the relationship between change in red and processed meat consumption and participants' willingness to eat less meat and dairy measured shortly after the intervention and one month later, or participants' willingness to take shorter showers, buy an eco-friendly product, buy a product with less packaging, buy local rather than imported produce, or eat seasonal foods, measured one month after the intervention. Thus, the results did not show any evidence that behavioural difficulty had a moderating effect on the relationship between red and processed meat reduction and participants' willingness to engage in different pro-environmental behaviours at the end of the two-week intervention or one month later.

Table 28. Hierarchical multiple regression parameters of change in red and processed meat consumption (T3 – T1) and behavioural difficulty (T3) as predictors of participants' willingness to engage in pro-environmental behaviours at T3

		B	SE (B)	β	t	*p*
Have shorter showers or infrequent baths						
Model 1	Change in red and processed meat consumption	-0.10	0.04	-0.19	-2.58	0.011*
	Behavioural difficulty	-0.17	0.11	-0.12	-1.60	0.111
Model 2	Change in red and processed meat consumption	-0.98	0.04	-0.18	-2.53	0.012*
	Behavioural difficulty	-0.18	0.11	-0.12	-1.64	0.102*
	Change in red and processed meat consumption * Behavioural difficulty	0.02	0.03	0.05	0.72	0.470
Purchase an eco-friendly product						
Model 1	Change in red and processed meat consumption	-0.10	0.03	-0.23	-3.10	0.002**
	Behavioural difficulty	-0.03	0.09	-0.02	-0.31	0.760
Model 2	Change in red and processed meat consumption	-0.10	0.03	-0.22	-3.04	0.003**

	Behavioural difficulty	-0.03	0.09	-0.03	-0.04	0.719
	Change in red and processed meat consumption * Behavioural difficulty	0.22	0.03	0.06	0.83	0.408
Buy a product with less packaging						
Model 1	Change in red and processed meat consumption	-0.08	0.04	-0.17	-2.26	0.025*
	Behavioural difficulty	-0.18	0.10	-0.13	-1.84	0.068
Model 2	Change in red and processed meat consumption	-0.08	0.04	-0.17	-2.34	0.020*
	Behavioural difficulty	-0.17	0.10	-0.13	-1.75	0.081
	Change in red and processed meat consumption * Behavioural difficulty	-0.35	0.03	-0.09	-1.22	0.225
Buy local rather than imported food produce						
Model 1	Change in red and processed meat consumption	-0.08	0.03	-0.17	-2.35	0.020*
	Behavioural difficulty	-0.07	0.09	-0.05	-0.74	0.461
Model 2	Change in red and processed meat consumption	-0.08	0.03	-0.17	-2.35	0.020*
	Behavioural difficulty	-0.07	0.10	-0.05	-0.73	0.470

	Change in red and processed meat consumption * Behavioural difficulty	-0.00	0.03	-0.01	-0.02	0.877
Eat seasonal fruits and vegetables						
Model 1	Change in red and processed meat consumption	-0.09	0.03	-0.20	-2.72	0.007**
	Behavioural difficulty	-0.09	0.10	-0.07	-0.91	0.364
Model 2	Change in red and processed meat consumption	-0.09	0.03	-0.20	-2.68	0.008**
	Behavioural difficulty	-0.09	0.10	-0.07	-0.94	0.350
	Change in red and processed meat consumption * Behavioural difficulty	0.01	0.03	-0.03	-0.46	0.644
Reduce my consumption of meat and dairy products						
Model 1	Change in red and processed meat consumption	-0.07	0.04	-0.13	-1.96	0.052*
	Behavioural difficulty	-0.56	0.10	-0.39	-5.69	<0.001**
Model 2	Change in red and processed meat consumption	-0.07	0.04	-0.14	-2.05	0.042
	Behavioural difficulty	-0.55	0.10	-0.38	-5.60	<0.001**
	Change in red and processed meat consumption * Behavioural difficulty	-0.04	0.03	-0.10	1.42	0.157

Note: * $p < 0.05$, ** $p = < 0.01$. Variables are mean centered

7.3.4 Contribution ethic and behavioural spillover

Finally, analysis was conducted to assess whether the previously established relationships between red and processed meat reduction and participants' increased willingness to engage in the different pro-environmental behaviours at T2 and T3 (see section 7.3.1), would be moderated by contribution ethic. Specifically, it was thought that contribution ethic would change the direction of the relationship between change in red and processed meat consumption and participants' willingness to engage in the different pro-environmental behaviours, where participants who reduced their red and processed meat consumption would be less willing to engage in other pro-environmental behaviours if they had a strong contribution ethic. This was tested using hierarchical regression analysis with a change in red and processed meat*contribution ethic interaction term, to test whether the interaction term would explain significantly more variance in participants' willingness to engage in different pro-environmental behaviours when controlling for the independent effects of each variable. The variables were mean centred prior to regression analyses as in the previous section (7.3.3).

7.3.4.1 Mean contribution ethic

The descriptive statistics show that participants did not have a particularly high or low contribution ethic, with scores clustering around the midpoint at T2 ($M = 3.70$, $SD = 0.93$) and T3 ($M = 3.68$, $SD = 0.88$). Thus, participants appeared to consider that they had contributed towards protecting the environment in some way, but did not feel that they had done more than their 'fair share', shortly after the intervention or one month later.

7.3.4.2 Effects of contribution ethic at T2

Hierarchical regression analysis was conducted to test the moderation of contribution ethic on the relationship between change in red and processed meat consumption (T2 – T1) and participants' willingness to eat less meat and dairy, measured at T2. Change in red and processed meat consumption (T2 – T1) and contribution ethic (T2) were entered in block 1 and a change in red and processed meat consumption*contribution ethic interaction term was entered in block 2, with willingness to eat less meat and dairy as the dependent variable. The results are summarised in Table 29. The overall regression model was not significant (F (3, 188) = 2.35, p = 0.074, adjusted R^2 = 0.02) when considering either uncorrected or Holm-Bonferroni corrected p-values. Change in red and processed meat consumption with contribution ethic explained 3% of variance in block one (R^2 = 0.03). Adding the interaction term explained only an additional 1% of variance and did not significantly improve the model (R^2 change = 0.01, F change (1, 188) = 2.07, p = 0.152). In the final model, neither change in red and processed meat consumption, contribution ethic nor the interaction term, were significant predictors of participants' willingness to eat less meat and dairy (see Table 29). Thus, there was no evidence to suggest that having a strong contribution ethic moderated the relationship between red and processed meat reduction and participants' willingness to eat less meat and dairy, measured shortly after the two-week intervention period.

7.3.4.3 Effects of contribution ethic at T3

Hierarchical regression analyses were conducted to test the moderation of contribution ethic on the relationship between change in red and processed meat consumption (T3 – T1) and participants' willingness to: have shorter showers or infrequent baths, buy an eco-friendly product, buy a product with less packaging, buy local rather than imported food, eat seasonal fruits and vegetables, and to eat less meat and dairy, measured at T3. A separate regression model was conducted for each of the pro-environmental behaviours. For each model, change in red and processed meat consumption (T3 – T1) and contribution ethic (T3) were entered in block 1 and a change in red and processed meat *contribution ethic interaction term was entered in block 2, with willingness to engage in each pro-environmental behaviour as the dependent variables. The results are summarised in Table 30 and are reported below.

Willingness to have shorter showers or infrequent baths

As shown by Table 30, the model significantly predicted participants' willingness to take shorter showers or infrequent baths (F (3, 180) = 5.93, p = 0.001, adjusted R^2 = 0.08) when considering the uncorrected p-value. Change in red and processed meat consumption with contribution ethic in block 1 explained 9% of variance (R^2 = 0.09). Adding the interaction term did not explain any additional variance and did not significantly improve the model (R^2 change = 0.00, F change (1, 180) = 0.41, p = 0.524). In the final model, both change in red and processed meat consumption and contribution ethic were significant predictors, where a reduced consumption of red and processed meat, and a strong contribution ethic, was associated with an increased willingness to have shorter showers or infrequent baths. The change in red and processed meat*contribution ethic interaction term was not a significant predictor when controlling for independent effects of each variable (see Table 30). It should be noted that the overall model was no longer significant when applying Holm-Bonferroni correction.

Willingness to purchase an eco-friendly product

As shown by Table 30, the model significantly predicted participants' willingness to purchase an eco-friendly product (F (3, 180) = 4.75, p = 0.003, adjusted R^2 = 0.06) when considering the uncorrected p-value. Change in red and processed meat consumption with contribution ethic explained 7% of variance in block 1 (R^2 = 0.07). Adding the interaction term did not explain any additional variance in block 2 and did not significantly improve the model (R^2 change = 0.00, F change (1, 180) = 0.00, p = 0.968). In the final model, change in red and processed meat reduction was a significant predictor. There was also a marginally significant effect of contribution ethic which was associated with an increased willingness to purchase an eco-friendly product when controlling for change in red and processed meat consumption (see Table 30). The interaction term was not a significant predictor when controlling for the independent effects of each variable. It should be noted that the overall model was no longer significant when applying Holm-Bonferroni correction.

Willingness to buy a product with less packaging

As shown by Table 30, the model significantly predicted participants' willingness to buy a product with less packaging (F (3, 180) = 3.76, p = 0.027, adjusted R^2 = 0.04) when considering the uncorrected p-value. Change in red and processed meat consumption with contribution ethic explained 5% of variance in block 1 (R^2 = 0.05). Adding the interaction term explained only an additional 1% of variance and did not significantly improve the model (R^2 change = 0.01, F change (1, 180) = 1.84, p = 0.177). The only significant predictor in the final model was change in red and processed meat consumption. Contribution ethic did not significantly predict participants' willingness to buy a product with less packaging when controlling for change in red and processed meat consumption (see Table 30). The interaction term was also not a significant predictor when controlling for the independent effects of each variable. The overall model was no longer significant when applying Holm-Bonferroni correction.

Willingness to buy local rather than imported produce

The model significantly predicted participants' willingness to buy local rather than imported produce (F (3, 180) = 3.10, p = 0.028, adjusted R^2 = 0.03) when considering the uncorrected p-value. Change in red and processed meat consumption with contribution ethic explained 5% of variance in block 1 (R^2 = 0.05). Adding the interaction term did not explain any additional variance and did not significantly improve the model (R^2 change = 0.00, F change (1, 180) = 0.71, p = 0.401). Change in red and processed meat consumption was the only significant predictor in the final model (see Table 30). Contribution ethic did not significantly predict participants' willingness to buy local rather than imported produce when controlling for change in red and processed meat consumption. The interaction term was also not a significant predictor when controlling for the independent effects of each variable. The overall model was no longer significant when applying Holm-Bonferroni correction.

Willingness to eat seasonal fruits and vegetables

The model significantly predicted participants' willingness to eat seasonal fruits and vegetables (F (3, 180) = 3.16, p = 0.026, adjusted R^2 = 0.03) when considering the uncorrected p-value. Change in red and processed meat consumption with contribution ethic explained 5% of variance in block 1 (R^2 = 0.05). Adding the interaction term in block 2 did not explain any additional variance and did not significantly improve the model (R^2 change = 0.00, F change (1, 180) = 0.00, p = 0.981). In the final model, only change in red and processed meat consumption was a significant predictor (see Table 30). Contribution ethic did not significantly predict participants' willingness to eat seasonal fruits and vegetables when controlling change in red and processed meat consumption. The interaction term was also not a significant predictor when controlling for the independent effects of each variable. Furthermore, the overall model was no longer significant when applying Holm-Bonferroni correction.

Willingness to eat less meat and dairy

As shown by Table 30, the model significantly predicted participants' willingness to eat less meat and dairy (F (3, 180) = 2.87, p = 0.038, adjusted R^2 = .03) when considering the uncorrected p-value. Change in red and processed meat with contribution ethic explained 4% of variance in block 1 (R^2 = 0.04). Adding the interaction term in block 2 explained only an additional 1% of variance and did not significantly improve the model (R^2 change = 0.01, F change (1, 180) = 1.44, p = 0.232). In the final model, change in red and processed meat consumption was not a significant predictor. Contribution ethic did not significantly predict participants' willingness to eat less meat and dairy when controlling for change in red and processed meat. The interaction term was also not a significant predictor when controlling for the independent effects of each variable. The overall model was no longer significant when applying Holm-Bonferroni correction.

7.3.4.4 Section summary

Overall, the results did not show any evidence to suggest that the relationship between red and processed meat reduction and participants' willingness to engage in additional pro-environmental behaviours, as previously established in section 7.3.1, was moderated by contribution ethic. There was no significant interaction effect of contribution ethic on participants' willingness to reduce their consumption of meat and dairy shortly after the intervention and one month later, or on participants' willingness to take shorter showers, buy an eco-friendly product, buy a product with less packaging, buy local rather than imported produce, or eat seasonal fruits and vegetables, measured one month after the intervention. Thus, contribution ethic did not impact upon the strength or direction of the relationship between reduced red and processed meat consumption and participants' willingness to perform different pro-environmental behaviours.

Table 29. Multiple regression parameters of change in red and processed meat consumption (T2 -T1) and contribution ethic (T2) as predictors of participants' willingness to eat less meat and dairy measured at T2

		B	SE (B)	β	t	*p*
Model 1	Change in red and processed meat consumption	-0.05	0.03	-0.13	-1.74	0.083
	Contribution ethic	0.13	0.15	0.07	0.92	0.359
Model 2	Change in red and processed meat consumption	-0.06	0.03	-0.15	-1.97	0.050
	Contribution ethic	0.12	0.15	0.06	0.84	0.401
	Change in red and processed meat consumption * Contribution ethic	-0.04	0.03	-0.11	-1.44	0.152

Note: variables are mean centered

Table 30. Multiple regression parameters of change in red and processed meat consumption (T3 – 1) and contribution ethic (T3) as predictors of participants' willingness to eat less meat and dairy measured at T3

		B	SE (B)	β	t	*p*
Have shorter showers or infrequent baths						
Model 1	Change in red and processed meat consumption	-0.10	0.04	-0.19	-2.65	0.009**
	Contribution ethic	0.51	0.17	0.22	3.10	0.002**
Model 2	Change in red and processed meat consumption	-0.10	0.04	-0.19	-2.70	0.008
	Contribution ethic	0.48	0.17	0.21	2.78	0.006**
	Change in red and processed meat consumption * Contribution ethic	-0.32	0.05	-0.05	-0.064	0.524
Purchase an eco-friendly product						
Model 1	Change in red and processed meat consumption	-0.10	0.03	-0.22	-3.08	0.002**
	Contribution ethic	0.29	0.14	0.15	2.06	0.041
Model 2	Change in red and processed meat consumption	-0.10	0.03	-0.22	-3.06	0.003**

	Contribution ethic	0.29	0.15	0.15	1.95	0.05
	Change in red and processed meat consumption * Contribution ethic	-0.00	0.04	-0.00	-0.04	0.968
Buy a product with less packaging						
Model 1	Change in red and processed meat consumption	-0.08	0.04	-0.17	-2.35	0.020*
	Contribution ethic	0.28	0.15	0.14	1.86	0.065
Model 2	Change in red and processed meat consumption	-0.09	0.04	-0.18	-2.50	0.014*
	Contribution ethic	0.22	0.16	0.11	1.40	0.167
	Change in red and processed meat consumption * Contribution ethic	-0.06	0.05	-0.10	-1.36	0.177
Buy local rather than imported food produce						
Model 1	Change in red and processed meat consumption	-0.08	0.03	-0.17	-2.37	0.019*
	Contribution ethic	0.24	0.15	0.12	1.62	0.106
Model 2	Change in red and processed meat consumption	-0.08	0.03	-0.17	-2.28	0.024*
	Contribution ethic	0.27	0.15	0.14	1.80	0.074

	Change in red and processed meat consumption * Contribution ethic	0.04	0.04	0.06	0.84	0.401
Eat seasonal fruits and vegetables						
Model 1	Change in red and processed meat consumption	-0.09	0.03	-0.20	-2.77	0.006**
	Contribution ethic	0.19	0.15	0.09	1.24	0.215
Model 2	Change in red and processed meat consumption	-0.09	0.03	-0.20	-2.74	0.007**
	Contribution ethic	0.19	0.16	0.09	1.19	0.234
	Change in red and processed meat consumption * Contribution ethic	-0.00	0.05	-0.00	-0.02	0.981
Reduce my consumption of meat and dairy products						
Model 1	Change in red and processed meat consumption	-0.08	0.04	-0.16	-2.23	0.027*
	Contribution ethic	0.23	0.16	0.10	1.37	0.172
Model 2	Change in red and processed meat consumption	-0.09	0.04	-0.17	-2.34	0.021
	Contribution ethic	0.17	0.17	0.07	0.97	0.336

	Change in red and processed meat consumption * Contribution ethic	-0.06	0.05	-0.09	-1.42	0.232

Note. * $p < 0.05$, ** $p < 0.01$, variables are mean centered

7.4 Chapter summary and Conclusions

7.4.1 General summary

This chapter used survey data collected at baseline, shortly after the randomised messaging intervention, and one month later, to investigate whether participants who reduced their red and processed meat consumption would be more willing to perform other untargeted pro-environmental behaviours, as a result of pro-environmental behavioural spillover. Based on past literature, the effects of pro-environmental identity, behavioural difficulty, and contribution ethic on any spillover effects were also examined (see section 7.1).

The results did not show any conclusive evidence of behavioural spillover. When controlling for multiple comparisons, there was no significant relationship between reduced red and processed meat consumption and participants' willingness to perform the different pro-environmental behaviours measured shortly after the randomised messaging intervention or one month later. However, there were some relationships found to be significant prior to correction (with α of 0.05), which can be useful in identifying the potential behaviours for which spillover might occur following a reduced meat consumption. Considering the uncorrected *p*-values, the results showed a marginal effect where a reduced consumption of red and processed meat during the two-week intervention was associated with an increased willingness to eat less meat and dairy. A reduced consumption of red and processed meat one month after the intervention was associated with an increased willingness to engage in a number of other untargeted pro-environmental behaviours, including an increased willingness to have shorter showers or infrequent baths, buy an eco-friendly product, buy a product with less packaging, buy local rather than imported food, eat seasonal fruits and vegetables, and eat less meat and dairy. Thus, future research might consider whether a reduced consumption of red and processed meat over a sustained period of time (i.e. one month), might have the potential to elicit positive spillover for specific private-sphere behaviours, including those noted above.

The results showed that the intervention did not have any significant effects on pro-environmental identity and that pro-environmental identity did not have any significant effect on participants' willingness to engage in different pro-environmental behaviours. The fact that the intervention did not have an effect on participants' pro-environmental identity can be explained by evidence that reducing one's meat consumption is not an environmentally salient behaviour, given that many people are not aware of the negative environmental impacts associated with meat (e.g. Bailey et al.,2014; Macdiarmid et al., 2016). This is likely to be the case in the current study, given that participants received different types of information (i.e. relating to the environment and/or health), whereas past literature which has demonstrated an increased pro-environmental identity following meat reduction has provided information solely on the environmental impacts of meat (Verfuerth et al., 2019) or has found spillover effects only through an increased environmental concern (Carrico et al., 2018), which was not measured in this study. This could also explain the lack of evidence for behavioural spillover in the current study, given that an increased pro-environmental identity can act as a catalyst for positive spillover (e.g. Cornelissen, et al., 2008; Van der Werff, et al., 2014).

Interestingly, the results showed that behavioural difficulty was associated with a decreased willingness to eat less meat and dairy shortly after the intervention and at the one-month follow-up, even when controlling for multiple comparisons. The fact that participants who found reducing their red and processed meat consumption to be difficult were less willing to reduce their meat and dairy consumption in the future is somewhat intuitive; participants might be dissuaded from further attempting to further change their diet since this was already difficult for them to achieve. On the other hand, past literature has indicated that an increased perceived difficulty of a past pro-environmental behaviour should lead to positive spillover for other untargeted pro-environmental behaviours (e.g. Truelove et al., 2014). Thus, it was thought that the relationship between change in red and processed meat consumption and participants' willingness to engage in pro-environmental behaviours would be stronger for those who found reducing their red and processed meat to be more difficult. However, there was no evidence to support this. This adds to existing literature which has also found limited and mixed evidence in relation to the role of behavioural difficulty on influencing behavioural spillover (e.g. Maki et al., 2019; Van der Werff et al., 2019).

Finally, the results did not show any evidence that the relationship between red and processed meat reduction and participants' willingness to engage in other pro-environmental behaviours was moderated by contribution ethic. Thus, a reduced consumption of red and processed meat was not associated with a decreased willingness to perform additional pro-environmental behaviours via contribution ethic. This is a promising finding, given past evidence that pro-environmental behaviour change interventions can inadvertently increase negative environmental impacts through negative spillover effects, as a result of moral licensing or contribution ethic effects (e.g. Tiefenback et al., 2013).

Overall, there was limited evidence of positive behavioural spillover. However, the results showed some tentative evidence for the types of pro-environmental behaviours which individuals may be more willing to perform following reduced consumption of red and processed meat, providing a useful starting point for further, more targeted, research. A reduced consumption of red and processed meat did not appear to increase pro-environmental identity and change in pro-environmental identity did not appear to increase participants' willingness to perform additional pro-environmental behaviours. There was no evidence to suggest that behavioural difficulty increased, or that contribution ethic decreased, the strength in the relationship between red and processed meat consumption and positive spillover. These findings contribute to the emerging literature investigating behavioural spillover following meat reduction and adds to existing literature which has yielded mixed results in relation to the effects of contribution ethic and behavioural difficulty on pro-environmental behavioural spillover.

7.4.2 Contributions to the literature

Very few studies have investigated whether reduced meat consumption might lead to an increased willingness to perform untargeted pro-environmental behaviours through behavioural spillover. The current study therefore adds to emerging literature in this area, by investigating whether individuals might be more willing to perform various pro-environmental behaviours following reduced meat consumption, and by investigating the potential mechanisms through which spillover might occur. The current study did not yield any conclusive evidence of behavioural spillover, contrasting with two recent studies which found increased pro-environmental behaviour following reduced meat consumption. However in these studies, spillover was found to occur through specific psychological processes including an increased environmental concern (Carrico et al., 2017) and increased pro-environmental identity (Verfuerth et al., 2019). Therefore, the findings from the current study suggest that encouraging reduced meat consumption in isolation might not be sufficient to elicit pro-environmental behavioural spillover. This adds to the existing literature demonstrating the role of different psychological mechanisms underpinning behavioural spilover (e.g. Truelove et al. 2014) and suggests that interventions aimed at reduced meat consumption may also need to focus on factors such as environmental identity and environmental concern, to encourage far reaching pro-environmental behaviour change.

Chapter 8: General Discussion

8.1 Introduction

This thesis sought to address three main overarching aims: First, this thesis aimed to investigate the motives driving meat consumption and meat reduction as well as awareness of the negative environmental impacts of meat, among individuals who include and exclude meat from their diet. Second, this thesis aimed to test the effectiveness of providing information on the environmental, health and the combined environmental and health impacts of meat, on reducing red and processed meat consumption, whilst also investigating what foods might be used to replace red and processed meat in one's diet. Third, this thesis aimed to investigate whether reduced red and processed meat consumption might lead to an increased willingness to perform untargeted pro-environmental behaviours through behavioural spillover, as well as the effects of pro-environmental identity, behavioural difficulty, and contribution ethic on any spillover effects. A mixed-methods approach was used to address these aims through an initial qualitative study involving semi-structured interviews with meat-eating and meat-free (vegetarian and vegan) participants (study 1), followed by a quantitative study consisting of a randomised messaging intervention, food diaries, and series of surveys completed across three time points (study 2). This chapter discusses the findings of these two studies in relation to the aims of this thesis, with implications for research and practice.

The remainder of this discussion chapter is structured as follows: Section 8.2 draws on the findings from study 1, as well as baseline data collected during study 2, to discuss motives driving meat consumption, awareness of the environmental impacts of meat, and motives for meat reduction. Section 8.3 draws on the findings from survey and diary data collected as part of study 2, to discuss the effectiveness of environmental, health and combined messages in reducing red and processed meat consumption, as well as the types of foods used to replace red and processed meat. Section 8.4 draws on survey data collected during study 2 to discuss the effect of red and processed meat reduction on promoting positive behavioural spillover, as well as the potential effects of pro-environmental identity, behavioural difficulty, and contribution ethic on any spillover effects. Each of these sections (8.2, 8.3, 8.4) discusses the findings in relation to existing literature, as well as the aims of this thesis. Section 8.5 reflects on the methods of this thesis and their relative strengths and weaknesses. Section 8.6 discusses implications for future research and policy aimed at meat reduction. Finally, section 8.7 provides the conclusion for this thesis.

8.2 Motives driving meat consumption, meat reduction and awareness of the negative environmental impacts of meat

The first aim of this thesis was to explore the motives driving meat consumption and meat reduction, as well as awareness of the negative environmental impacts of meat. This was explored in two ways. First, study 1 used qualitative interviews to ask meat-eating participants about their reasons for eating meat, their awareness about the negative environmental impacts of meat and their willingness to reduce their meat consumption. Qualitative interviews were also conducted with meat-free (vegan and vegetarian) participants, to investigate their awareness of the negative environmental impacts of meat and their reasons for adopting a meat-free diet. Second, study 2 investigated psychosocial factors associated with (meat-eating) participants' willingness to reduce their red and processed meat consumption, specifically. This section discusses the interview and survey findings, in relation to existing literature and the first aim of this thesis.

8.2.1 Motives driving meat consumption and barriers to reduction

In line with past literature, the interviews with meat-eating participants indicated that the main motives driving meat consumption were taste and health, as well as habits and social and cultural norms (e.g. Bastian & Loughnan, 2017; Bohm, et al., 2015; de Boer et al., 2017; Macdiarmid, et al., 2016; Piazza et al., 2015). Although participants stated that they ate meat because it was tasty and healthy, the interviews with both meat-eating and meat-free participants showed that social norms also played a significant role in driving meat consumption, as well as acting as a barrier towards meat reduction. For example, meat-eating participants felt that it was easier to eat the same meals as those within the same household and also felt socially pressured to eat meat, while meat-free participants mentioned social stigma associated with vegetarian and vegan diets. Thus, as indicated by past literature, social norms were found to encourage meat consumption by legitimising it as a social practice whilst discouraging meat reduction through fear of social disapproval (Schenk, Rössel & Scholz, 2018). This highlights a need for broader social interventions to reduce meat consumption (see section 8.6). Issues relating to animal welfare and the environment did not appear to influence meat-eating participants' dietary choices, supporting existing literature (e.g. de Boer et al., 2017; Macdiarmid, et al., 2016; Piazza et al., 2015

8.2.2 Awareness of environmental impact

In support of previous research, the interviews showed that meat-eating participants tended to be unaware of the negative environmental impacts of meat (e.g. Bailey et al., 2014; de Boer et al., 2016; Macdiarmid et al., 2016; Tobler et al., 2011; Truelove & Parks, 2012). Similar to the findings of Macdiarmid et al. (2016), meat-eating participants did not appear to associate meat production with climate change and instead tended to focus on issues such as food transportation or packaging. Meat-eating participants were also sceptical of the impact of meat on climate change and indicated that there needed to be more evidence to prove this link. Related to this, meat-eating participants did not feel that reducing their meat consumption would have much of a positive effect on the environment and did not tend to feel personally responsible for mitigating environmental issues related to meat production.

In contrast, meat-free participants were much more aware of the negative environmental impacts associated with meat, including climate change[18]. Compared to meat-eating participants, meat-free participants were much more likely to view eating less meat as having a positive impact on the environment and on mitigating climate change. Meat-free participants also tended to view individual consumers as being responsible for mitigating environmental issues related to food. This supports

[18] It should be noted that while some meat-free participants were sampled from an environmental group, environmental awareness and concern was found to be consistent across meat-free participants.

past literature which has shown that individuals who eat meat more regularly view reducing their meat consumption as having a lesser positive environmental impact compared to those who eat meat less often (de Boer et al., 2016; Mullee et al., 2017; Tobler et al., 2011). As a result, meat-free participants felt that they personally made a substantial positive impact on the environment as a result of following a meat-free diet and some participants mentioned that they had saved significant numbers of trees and had substantially reduced greenhouse gas emissions as a result of choosing not to eat meat. This further supports past literature demonstrating that the perceived impact of reducing one's meat consumption on mitigating climate is associated with an increased willingness to do so (Truelove et al., 2012; de Boer et al., 2016). It is interesting to note that meat-free participants appeared to actively seek out information about the different impacts of meat and many stated that the environment was now the main factor motivating their decision not to eat meat, even if it was not the initial driving factor. This supports the argument that people's motivations for avoiding meat are not static and can be modified over time (Beardsworth & Keil, 1992). Thus, interventions aimed at meat reduction could potentially result in an increased awareness and concern for environmental issues, even if individuals are encouraged to reduce their meat consumption for other reasons.

8.2.3 Motives driving meat reduction and related psychosocial factors

The results from the surveys with a meat-eating participant sample showed that the majority of the participants were in the precontemplation stage of change, meaning the majority of participants had not previously considered reducing their red and processed meat consumption. This adds to the limited existing literature which has also evidenced a tendency for people to show a low readiness to reduce their meat consumption (Klöckner & Ofstad, 2017; Lea, et al., 2006; Weller et al., 2014). It is important to note that individuals tend to be in the precontemplation stage for a given behaviour when they are unaware of the negative impacts of that behaviour (Prochaska & Velicer, 1997). Thus, the fact that individuals tend to be in the precontemplation stage for meat reduction, as indicated by this study as well as past literature, might be explained by the fact that people tend to be unaware of the negative impacts of meat on the environment (e.g. Bailey et al.,2014; Macdiarmid et al., 2016). This highlights the importance of raising awareness of the environmental impacts of meat to increase people's willingness to reduce their consumption (see section 8.6).

Although participants tended to show a low readiness to reduce their meat consumption, they were not unwilling to do so. For example, the survey data showed that participants' intentions to reduce their meat intake clustered around the midpoint. The survey findings also shed some light on the psychosocial factors involved in increasing participants' readiness and intentions to reduce their meat consumption. Specifically, the findings showed that viewing meat reduction positively and feeling socially pressured to reduce one's meat consumption was important in increasing readiness and intentions to eat less red and processed meat. The results also highlighted that an increased readiness to reduce red and processed meat was associated with reduced perceived barriers towards doing so. In contrast to past literature applying the TTM to other health-related behaviours (e.g. Prochaska, 1994; Hall & Rossi, 2008), the survey results indicated that for meat reduction, decreasing the perceived barriers was more important than increasing the perceived benefits associated with this behaviour. Thus, while promoting positive attitudes towards eating less meat and normalising a reduced meat diet might play an important role in increasing people's willingness to reduce their meat consumption, increasing people's confidence in their ability to reduce their meat intake and removing potential barriers associated with doing so, will be essential to motivating this dietary shift.

The qualitative interviews provided more insight into the motives driving meat reduction. The interviews showed that meat-eating participants were generally willing to reduce their meat consumption for different reasons, but were the most willing to reduce their meat consumption to benefit their health. Participants were less willing to reduce their meat consumption for the environment and for issues relating to animal welfare. This supports past literature demonstrating the role of health in motivating meat reduction above other motives, such as environmental concern (e.g. Cordts et al.,2014; Jagers et al.,2017). Although participants were concerned about different issues related to animal welfare and the environment, these issues did not tend to influence meat-eating participants' behaviour. This is reflective of the commonly cited 'meat-paradox', whereby many individuals continue to eat meat despite viewing it negatively (Loughnan et al., 2010). Some participants explained that this was because issues relating to the production of meat were not salient at the point of purchase. This is consistent with past literature indicating that issues such as animal welfare, do not tend to be activated in shopping situations (Hoogland et al., 2005). This is compounded by a loss of transparency in the food chain, where food is marketed, sold and prepared in ways that conceal its animal origin (Bastian & Loughnan, 2017; Hoogland et al., 2005). Making these issues more salient at the point of purchase might therefore be a promising strategy for encouraging meat reduction (see section 8.6).

In contrast to meat-eating participants, the interviews with meat-free participants showed animal welfare to be the main motive for vegan and vegetarian diets, while issues related to the environment and to a lesser extent health, helped to reinforce these dietary decisions. This supports past literature which has also evidenced animal welfare to be a main motive driving meat-free diets, with environmental motives also playing a role in motivating meat reduction (e.g. Fox and Ward, 2008a; Lentz et al., 2018; Ruby et al., 2012). Together, these findings add to recent emerging literature demonstrating that motives for meat reduction can differ across consumer groups, where animal welfare tends to be a more prominent motive among consumers who have already reduced their meat consumption, while health is a more prominent factor among consumers who regularly eat meat (De Boer et al., 2017; Lentz et al., 2018). This highlights that future research should focus on the motives driving meat reduction among meat-eaters, given that this would be the target population for interventions aimed at reducing excess meat consumption.

The interviews with meat-free participants revealed other factors associated with the transition to meat-free diets, which could be useful for developing future strategies aimed at meat reduction. For example, there appeared to be a link between certain transitional life moments, such as moving to a new house or starting a new job, and dietary shifts towards becoming vegan or vegetarian. This supports recent literature demonstrating that significant transitions in one's life course can disrupt existing habits and make people more receptive to information, in turn facilitating behaviour change (Verplanken & Roy, 2015). Although the literature is currently sparse, there is some evidence for significant life transitions in influencing meat consumption. For example, Jabs, Devine and Sobal (1998) found that transitions towards a meat-free diet were, for some participants, associated with enrolment on a higher educational degree, divorce, changing careers and moving to a new house. However, Menzies and Sheeshka (2012) more recently found that life transitions, including marriage, divorce or moving to a new job, led some participants to start eating meat after previously adopting a meat-free diet. Thus, significant life transitions appear to have both facilitating and hindering effects on meat reduction.

Another important factor facilitating transitions to a vegan diet was being able to 'trial' being vegan for a specified time. Some participants had become vegan after taking part in 'Veganuary', a campaign to follow a vegan diet during January (see uk.veganuary.com). Participants appreciated that taking part in Veganuary allowed them to try being vegan without feeling pressured to continue the diet afterwards if it was too difficult. This trial appeared to act as a foot-in-the-door (e.g. Meineri & Guéguen, 2008), making it easier for participants to continue being vegan once the campaign month was over. Using similar short-term intervention strategies and targeting individuals during a transitional life moment therefore could increase the effectiveness of strategies aimed at meat reduction (see section 8.6).

8.2.4 Section summary

The first aim of this thesis was to explore the motives driving meat consumption and meat reduction, as well as awareness of the negative environmental impacts of meat. The results showed that meat consumption was driven by taste, health, habit and social norms, with these factors also acting as barriers towards meat reduction. Meat-eating participants tended to be unaware of the environmental impacts of meat and the link between meat and climate change. On the other hand, meat-free participants were much more aware of these issues and showed a greater environmental concern, even if they had reduced their meat consumption for issues not relating to the environment. Meat-eating participants tended to show a low readiness to reduce their meat consumption but were not unwilling to do so. Meat-eating participants were the most willing to reduce their meat consumption for their health, while positive attitudes, increased subjective norms and reduced perceived barriers, were also important in increasing participants' readiness and intentions to reduce their consumption.

8.3 The effectiveness of environmental and health messages on reducing red and processed meat consumption

The second aim of this thesis was to investigate whether providing information on the environmental, health or the combined environmental and health impacts of red and processed meat would be effective in reducing participants' red and processed meat consumption. The types of food used to replace red and processed meat in participants' diets during the intervention was also investigated. This was tested as part of the randomised messaging intervention conducted during the second study presented in this thesis. White, red and processed meat consumption was measured before, during and one month after the intervention using surveys. Participants' consumption of white, red and processed meat, as well as fish and plant-based meat alternatives, was also recorded each day during the intervention using food diaries. This section discusses the results from both the surveys and food diaries, in relation to existing literature and the second aim of this thesis.

8.3.1 The effectiveness of health and environmental messages to reduce meat consumption

Overall, the results showed that providing information on the environmental, health, and combined environmental and health impacts of meat was effective in reducing red and processed meat consumption. Participants who received information on the environmental, health and combined impacts of meat, significantly reduced their red and processed meat consumption during the intervention compared to baseline and compared to control participants. All participants reduced their consumption of red meat one month after the intervention compared to baseline. Only participants who received the combined information significantly reduced their processed meat consumption compared to baseline and compared to control participants one month following the intervention.

These findings are consistent with existing literature, which has demonstrated that health messages (e.g. Bertolotti et al., 2019; Berndsen & Van Der Pligt, 2005; Cordts, et al., 2014) and to a lesser extent environmental messages (e.g. Graham & Abrahamse, 2017; Hunter & Röös (2016); Stea & Pickering, 2019), can be effective in encouraging meat reduction. These are promising findings which indicate that attempts to close the awareness gap regarding the impact of meat on contributing to climate change (e.g. Bailey et al., 2014; Macdiarmid, et al., 2016) could results in relevant behaviour change. Furthermore, these findings contribute to recent literature which has yielded mixed findings in relation to the use of combined messages on encouraging meat reduction (e.g. Amiot et al., 2018; Carfora, et al., 2019a). In fact, the results suggested that combining information on the environmental and health impacts of meat was in some cases more effective than providing this information independently, given that only participants who received the combined information significantly reduced their processed meat consumption one month after the intervention. This builds on previous literature demonstrating that pro-environmental behaviour, including meat reduction, can be driven by multiple motives (e.g. Jagers et al., 2017) and suggests that drawing on multiple motives can be an effective strategy for encouraging long lasting behaviour change.

It is interesting to note that providing information on the health impacts of meat did not have a significantly greater impact on reducing participants' red and processed meat consumption compared to when information was provided on environmental impacts. This is somewhat surprising, given that previous research has indicated health to be a more effective motivator in encouraging people to reduce their meat intake, compared to environmental motives (e.g. Clonan, Wilson, Swift, Leibovici & Holdsworth, 2015; Jagers et al., 2017). Furthermore, the qualitative interviews conducted in this thesis showed that meat-eating participants were more willing to reduce their meat consumption for health rather than environmental related reasons. This finding contributes to the literature and suggests that although health might be more readily cited as a motive for eating less meat, providing information on the negative health impacts of meat does not necessarily have a significantly greater effect on reducing red and processed meat consumption than providing information on the environmental impacts of meat. This is supported by a recent study which also did not find a significant difference in the extent to which participants who received information on the environmental or health impacts of meat reduced their red and processed meat consumption in Italy (Carfora et al., 2019a).

It is also interesting to note that the results from the food diaries showed that participants were not necessarily less likely to consume red and processed meat compared to those in the control condition. Only participants in the health condition were less likely than control participants to consume red and processed meat during each day of the intervention, although participants in the environment condition were also less likely than control participants to consume processed meat during the intervention. This indicates that even if participants ate fewer portions of red and processed meat during the intervention compared to baseline, they still included it in their diet. This is consistent with the findings of the qualitative interviews, which showed that meat-eating participants were reluctant to eliminate meat from their diet completely and preferred instead to eat *everything in moderation* (see chapter 4, section 4.2.3). This highlights that strategies might benefit from encouraging a reduced consumption of meat, rather than encouraging individuals to try to stop eating meat altogether (e.g. de Boer et al., 2017; see section 8.6). Moreover, diets including meat can still have low GHG emissions if meat is eaten in moderation (Tilman & Clark, 2014).

On the other hand, these results indicate that providing information on the health impacts of meat was particularly effective in reducing the amount of red and processed meat consumed as well as the likelihood of participants consuming red and processed meat. This would suggest that health messages might be more effective in motivating diets which include meat only during a few days of the week. This would be consistent with literature demonstrating health to be a motivating factor for vegetarian and flexitarian diets (e.g. De Backer & Hudders, 2014). It is not clear why participants in the environment condition were less likely to eat only processed (but not red) meat during each day of the intervention. A possible speculative explanation is that these participants might have found it easier to reduce their consumption of processed meat, compared to reducing their consumption of red meat. Investigating differences in the effects of interventions on different types of meat could be a worthwhile avenue for future research to better understand this effect. Investigating differences in the effectiveness of interventions on specific types of meat, including red meat and processed meat, could also provide useful information for the development of more targeted interventions, potentially increasing their efficacy.

It is interesting to note that while the study presented in this thesis demonstrated the effectiveness of environmental and/or health messages on reducing red and processed meat consumption, many studies indicate that information provision is not sufficient to elicit behaviour change (e.g. Abrahamse et al., 2005). Furthermore, past literature has evidenced backlash effects following interventions targeted at pro-environmental behaviour, including meat reduction. For example, Klöckner and Ofstad, (2017) found that participants increased their beef consumption after receiving different types of information about why and how they should eat less of it. The success of the intervention used in this thesis can in part be attributed to the content, linguistic style and delivery of the messages. Care was taken when designing the messages, for example considering the use of pre-factual ("if … then") message styles (e.g. Berlotti et al., 2016; 2019) and including a specific time-orientated goal (e.g. Cullen, Baronowski & Smith, 2001). Furthermore, various messages were sent to participants highlighting a different impact of meat each day, strengthening the argument for eating less meat. Delivering the intervention via a mobile phone app also enabled messages to be sent at specific times of day, in the morning and afternoon, and in a real-life setting, given that participants could receive messages in any location as long as they had access to their mobile phone. This might have also increased the likelihood of the information on influencing participants' food choice. Thus future interventions might consider implementing some of these techniques to increase the effectiveness of interventions aimed at meat reduction whilst minimising backlash effects (see section 8.6).

While the messaging intervention used in this thesis was effective in reducing participants' red and processed meat consumption, it is important to note other ways in which information strategies can be used to change behaviour. One technique is to tailor different types of information according to a person's readiness to change their behaviour, as indicated by their stage of change (Prochaska & Velicer, 1997). Indeed, past research has shown that tailoring interventions to the needs of individuals can increase their effectiveness (Krebs et al., 2010; Noar, Benac & Harris, 2007). Moreover, Klöckner and Ofstad (2017) found that participants tried to self-tailor their access to different types of information on beef consumption, indicating that different types of information may be preferable to individuals varying in their readiness to change. They also found that information tailored to participants' stage of change was more effective in increasing participants' readiness to reduce their beef consumption. However, they did not find any evidence that tailored information was more effective in reducing participants' beef consumption compared to non-tailored information. Therefore, investigating whether tailoring interventions to match a persons' readiness to change might increase the effectiveness of interventions aimed at reducing meat consumption could be a fruitful avenue for future research.

Framing information in terms of different values is another strategy to encourage pro-environmental behaviour. Values can be defined as goals which vary in importance and serve as guiding principles across different situations in one's life (Schwartz, 1992, 1994). Values provide a stable basis for attitudes and behaviours (Stern et al., 1995). In relation to meat consumption, self-transcendent values, comprised from concern for the welfare and interests of others (Schwartz, 1992, 1994), have been associated with vegetarianism. For example, universalism values, which is an example of self-transcendent values, has been associated with a preference for free-range meat and low meat consumption (de Boer, Hoogland & Boersema, 2007). Altruistic values have also been associated with vegetarianism (Dietz et al., 1995; Kalof, Dietz, Stern & Guagnano, 1999). In contrast, self-enhancement values which focus on pursuing success and dominance over others (Schwartz, 1992, 1994), has been associated with positive attitudes towards red meat (Allen & Ng, 2003). Therefore, it is possible that activating self-transcendent values could be an effective strategy to encourage reduced meat consumption. For example, Graham and Abrahamse (2017) found that providing information about the climate impacts of meat resulted in more negative attitudes towards eating meat when it was framed in terms of self-transcendent rather than self-enhancement values. However, they also found an interaction effect, whereby the self-enhancement message resulted in more negative attitudes towards eating meat for individuals who scored highly on a self-transcendence measure, compared to those scoring low on this measure. Therefore, highlighting certain values could be an effective strategy to encourage reduced meat consumption, while the attempts to tailor messages to match an individual's existing values may be more complex.

Attention should also be drawn to other strategies often used to fill the intention behaviour gap, that were not employed in this thesis. For example, setting implementation intentions, defining exactly when, where and how one can change their behaviour can be an effective strategy for encouraging goal directed behaviour (Gollwitzer, 1993; 1999; 2014). Recent evidence has supported the use of implementation intentions with mental contrasting, that is imagining the most positive future outcome of attaining a goal and identifying the main obstacle to achieving that goal (Oettingen, 2000; 2012; Oettingen, Pak & Schnetter, 2001) on increasing the likelihood that intentions to reduce meat will predict actual dietary change (Loy et al, 2016). Thus, there is scope for further research to investigate the potential for other techniques to maximize the effectiveness of informational strategies on encouraging meat reduction.

8.3.2 Foods used as meat replacements

Unfortunately, the results did not shed any light on the types of foods used to replace red and processed meat in participants' diets. The survey data showed that participants in the experimental (environment, health, combined) conditions did not significantly increase their white meat consumption during the intervention or one month later compared to baseline, while the diary data showed that these participants were also not significantly more likely to consume white meat, fish, or plant-based alternatives than control participants each day of the two-week intervention period. Thus, there was no evidence to suggest that white meat, fish or plant-based alternatives were used as replacement foods for red and processed meat. However, a limitation of this study is that participants' consumption of fish and plant-based alternatives was not measured prior to the messaging intervention, meaning that changes in participants' consumption of these foods during the intervention could not be compared to their consumption beforehand. This could be addressed in future research, to more effectively capture the types of foods that might be used to replace meat (see section 8.5).

Furthermore, white meat, fish and plant-based meat alternatives were chosen as potential meat-replacements in the current study, given that these foods were thought to be viable replacements for meat as suggested by past literature (e.g. Becerra-Tomas et al., 2016; Elzerman, et al., 2011; Hoek et al., 2011). However, participants might have chosen other foods to replace red and processed meat in their diet. For example, Schösler, de Boer and Boersema (2012) found that vegetarian meals such as pasta with pesto, Moroccan vegetables with couscous, omelette, and stir-fry with seitan, can also be viewed as acceptable replacements for meat. Thus, future research might benefit from investigating what types of foods might be used to replace meat, before investigating changes in the consumption of these foods following an intervention aimed at meat reduction (see section 8.5).

8.3.3 Section summary

Overall, the findings showed that providing information on the environmental, health and the combined environmental and health impacts of meat, was effective in reducing red and processed meat consumption, with a reduced consumption shown up to one month later. This highlights the usefulness of information provision as a potential strategy for encouraging dietary change. On the other hand, although participants who received information on the environmental and/or health impacts of meat reduced their red and processed meat consumption, they still included red and processed meat in their diet and were not necessarily less likely to consume red and processed meat compared to those in the no message control group. This indicates that participants preferred to eat everything in moderation rather than eliminating meat form their diet completely. Unfortunately, the results did not yield any conclusive evidence regarding the types of foods that were used by participants to replace red and processed in their diet. This is therefore an area that could be explored in future research.

8.4 Red and processed meat reduction and behavioural spillover

The third aim of this thesis was to investigate whether a reduced consumption of red and processed meat might lead to an increased willingness to perform other, untargeted pro-environmental behaviours, which is known as behavioural spillover (see chapter 2, section 2.5). This thesis also aimed to investigate whether any spillover effects might be attributed to an increased pro-environmental identity and whether behavioural difficulty might increase, and contribution ethic might decrease, the likelihood of spillover occurring following a reduced consumption of red and processed meat. The relationship between red and processed meat reduction and participants' willingness to perform other pro-environmental behaviours, as well as the potential mediating effect of environmental identity and moderating effects of behavioural difficulty and contribution ethic, were investigated using the survey data collected as part of the second study presented in this thesis. This section discusses the results from this data in relation to existing literature and the third aim of this thesis.

8.4.1 Behavioural spillover

The initial results showed that a reduced consumption of red and processed meat was associated with an increased willingness to reduce meat and dairy consumption when measured shortly after the intervention, in addition to an increased willingness to perform multiple pro-environmental behaviours including taking shorter showers and infrequent baths, reducing meat and dairy consumption, eating seasonal fruits and vegetables and buying eco-friendly products, as well as products with less packaging and local rather than imported produce, when measured one-month following the intervention. However, these effects were no longer significant when controlling for multiple comparisons using Holm-Bonferroni correction. These results therefore cannot be taken as direct evidence of behavioural spillover. However, these findings shed light on the types of pro-environmental behaviours which individuals might be more willing to perform as a result of reduced red and processed meat consumption, providing a useful starting point for more targeted research. For example, based on these findings, future research could investigate the effects of reduced meat consumption over a prolonged period (e.g. one month) on encouraging specific private-sphere behaviours, including environmentally conscious purchasing behaviour, sustainable food consumption and water saving behaviours.

8.4.2 Pro-environmental identity

The results showed no evidence that reduced consumption of red and processed meat led to an increased pro-environmental identity, or that an increased pro-environmental identity was associated with an increased willingness to perform additional pro-environmental behaviours. One possible explanation for these findings is that reducing one's meat consumption is not necessarily an environmentally salient behaviour, given that many people are not aware of the negative environmental impacts associated with meat (e.g. Bailey et al., 2014; Macdiarmid et al., 2016). This could also explain the lack of evidence for behavioural spillover found in this thesis, given that an increased pro-environmental identity can act as a catalyst for positive spillover (e.g. Cornelissen, et al., 2008; Van der Werff, et al., 2014). Future research could therefore focus on increasing the saliency of meat reduction as a pro-environmental behaviour, to promote pro-environmental identity and subsequent spillover effects. This is supported by recent evidence in which participants reported a stronger pro-environmental identity and an increased uptake of different pro-environmental behaviours following a workplace intervention, which focused specifically on the environmental impacts of meat (Verfuerth et al., 2019). This can also be supported by a past study which showed evidence of pro-environmental spillover after highlighting the environmental but not financial aspects of a behaviour (Evans et al., 2013). Although identity was not measured in this study, the authors explain that, in line with Schwartz' model of social values (1992), highlighting the environmental impacts of a behaviour would make self-transcendent values more salient leading to further related actions, while highlighting the financial impacts of the behaviour would have made self-interest values salient, increasing the likelihood of other self-interest rather than self-transcendent behaviours. In the current study, participants across the different messaging conditions were collapsed to compare the effect of meat reduction on eliciting behavioural spillover. However, future research could focus more specifically on the differences in making pro-environmental identity and/or self-transcendent values salient, on this effect.

8.4.3 Behavioural difficulty

The results also showed no evidence to support that the (tentative) relationships between a reduced consumption of red and processed meat and increased willingness to perform other pro-environmental behaviours would be moderated by behavioural difficulty. However, it should be noted that past evidence for the role of behavioural difficulty in promoting positive spillover has tended to rely on studies investigating pro-social rather than pro-environmental behaviour (e.g. Gneezy et al., 2012). On the other hand, there is little evidence to support the expected relationship between behavioural difficulty and positive pro-environmental behavioural spillover. For example, Van der Werff et al., (2014) found that signalling past behaviour as being difficult had no main effect on positive spillover, while a recent study found that a moderately difficult pro-environmental behaviour led to less positive spillover compared to an easier pro-environmental behaviour (Maki et al., 2019). Thus, the lack of evidence for the role of behavioural difficulty in encouraging positive spillover in this thesis adds to existing literature, which has also demonstrated mixed evidence for this effect.

8.4.4 Contribution ethic

Finally, the results showed no evidence to suggest a decreased willingness to perform pro-environmental behaviours via contribution ethic and showed no other evidence of negative behavioural spillover. This is an encouraging finding, given past evidence that pro-environmental behaviour change interventions can inadvertently increase environmental impacts through negative spillover effects, as a result of moral licensing or contribution ethic (e.g. Tiefenback et al., 2013). This supports recent evidence that interventions aimed at meat reduction have the potential to catalyse other pro-environmental lifestyle choices without being undermined by negative contribution ethic effects (e.g. Carrico et a., 2018; Verfuerth et al., 2019).

8.4.5 Section summary

Overall, the results suggest that a reduced consumption of red and processed meat could have the potential to catalyse other private-sphere pro-environmental behaviours without increasing negative environmental impact through contribution ethic effects. There was no evidence to suggest that the intervention had an effect on participants' pro-environmental identity, which could explain the lack of evidenced positive spillover. Behavioural difficulty also did not appear to have an effect on participants' willingness to perform the different pro-environmental behaviours adding to the mixed literature on this effect.

8.5 Methodological reflections, limitations, and future directions

8.5.1 Strengths and limitations of the methodological approach

This thesis used a mixed-methods approach, incorporating both qualitative and quantitative methods to investigate, broadly speaking, the psychological processes involved in meat consumption and meat reduction. While there is debate regarding the integration of both qualitative and quantitative research methods (e.g. Guba, 1990; Smith, 1983; Smith & Heshusius, 1986), this thesis views such disputes to be outdated (see chapter 3). Following this, a pragmatist approach was adopted to draw on the strengths while overcoming the weaknesses of qualitative and quantitative research designs (e.g. Johnson & Turner, 2003). The respective strengths and weaknesses associated with the sequential qualitative, quantitative mixed-methods design used in this thesis are discussed in this section, with suggestions for future research where appropriate.

The initial qualitative study used semi-structured interviews to provide an in-depth account of the motives driving meat consumption and meat reduction, as well as participants' awareness of the negative environmental impacts of meat. Using semi-structured interviews enabled a rich account of participants' views and experiences, which might not have been captured by other quantitative methods. For example, the impact of animal welfare concerns on motivating meat reduction among meat-free participants was captured by vivid detailed descriptions of the conditions in which animals are thought to be raised and slaughtered. In addition to providing a rich account of participant experiences, the qualitative study was used to generate areas of further investigation and fed into the development of the second quantitative intervention study. For example, the qualitative study revealed that meat-eating participants would be the most willing to reduce their meat consumption for health-related reasons, which inspired the use of health messages in the intervention study. Furthermore, the results from the qualitative interviews showed that meat-free participants became more aware and concerned with environmental issues after reducing their meat consumption even if they had reduced their meat consumption for reasons not related to the environment, which led to the investigation of behavioural spillover in the intervention study. Other insights into the tensions, complexities and temporal dynamics of food choices (e.g., conforming to social pressures; significant shifts in food habits following life transitions) also emerged from this exploratory stage.

However, qualitative data analysis has been criticised as being more subjective than quantitative research and open to sources of bias resulting from the expectations and personal beliefs of the researcher (Bryman, 2016; Johnson & Onwuegbuzie, 2004). It is therefore worth noting my own personal values and experiences, in order to be transparent about my potential biases as a researcher and the effect this could have had on the presented research (e.g. Yardley, 2000). I have followed a vegetarian diet myself for a number of years and identified with some of the experiences described from the meat-free participants throughout the interviews. These experiences include deciding to stop eating meat for reasons relating to animal welfare, being viewed as ‘weird’ for deciding not to eat meat among a family of meat-eaters, and becoming aware of the environmental impacts of meat only after I had already been vegetarian for a number of years, a realisation that led to the proposal of this thesis. It is therefore possible that I identified some themes more readily or unconsciously placed more emphasis on certain themes, as a result of my own experiences. I have attempted to minimise the inevitable pitfalls of research subjectivity by focussing on the grounded nature of the data, using participant quotes throughout, to evidence how the codes and themes reflect the interview content and transcripts. Nevertheless, it is possible that my views and values regarding meat may have still influenced my interpretation of participants’ responses.

Based on some of the findings from the initial qualitative study, a second, quantitative, study was used to investigate the psychosocial factors associated with meat reduction, as well as testing the effectiveness of environmental, health and combined messages on reducing red and processed meat consumption and encouraging a greater willingness to perform other pro-environmental behaviours through behavioural spillover. The quantitative study was able to complement the findings from the initial qualitative study. For example, the initial qualitative study revealed different barriers associated with meat reduction, while the quantitative study showed that reducing these barriers played a fundamental role in increasing participants’ readiness to reduce their meat consumption. The quantitative study also supported that health can be an effective motive for reducing red and processed meat consumption.

However, while the use of quantitative methods enabled the research aims to be addressed in a highly controlled way, there are limitations associated with the quantitative methods used in this thesis. For example, the survey measure of red and processed meat consumption required participants to indicate the number of servings of red and processed meat they had eaten in the previous week. Although participants were provided with example portion sizes, this might not have been sufficient to ensure a precise measure of participants' red and processed meat consumption. Furthermore, participants may not have been able to accurately recall the amount of red and processed meat they had consumed retrospectively, for the previous week. It is possible that the food diaries provided a more accurate representation of participants' red and processed meat consumption, as the food diaries allowed for food choices to be reported on a day-to-day basis and with different response options for different serving sizes. Indeed, food diaries are often used in dietary studies, as they enable food consumption to be monitored in real-time and can easily be combined with other measures to improve the accuracy of reporting (Zepeda & Deal, 2008).

Using food diaries as a measurement tool was particularly valuable in this thesis, as it enabled the investigation of foods used to replace red and processed meat during the intervention, whilst providing an additional measure of red and processed meat consumption. For example, the diary data supplemented the survey data by showing that even if participants reduced the number of servings of red and processed meat consumed, they still included it in their diet and were not necessarily less likely to consume it than control participants during the intervention. However, that the food diaries were completed only during the two-week intervention period is a limitation of this study, as the diary data could not be compared from before to during or after the intervention. Although comparing consumption during each day of the intervention can provide useful information on patterns of behaviour change among participants, there were limitations with this data. For example a floor effect of consumption was shown (see chapter 6, section 6.2), as participants can only consume a limited amount of food in any given day. This led to the transformation of continuous data to binary outcome variables which can lead to a loss of power (e.g. Fedorov et al., 2009). Thus, the extent to which this method enabled a comprehensive examination of participants' diets and dietary changes was limited.

On the one hand, it could be argued that future studies would benefit from implementing food diaries across all study time points, to enhance the accuracy of self-report measures of meat consumption and to provide more information on the types of foods used to replace meat in the diet. However, it is also worth noting that any type of self-report data, i.e. from surveys or diaries, can be influenced by social desirability. For example, participants might underreport their meat consumption in an attempt to please the experimenter. Furthermore, maintaining daily food diaries is demanding for participants which can lead to fatigue and high attrition rates (e.g. Lambe et al., 2000). For example, many participants stopped completing the food diaries towards the end of the two-week messaging intervention study presented in this thesis (see chapter 6). Thus, another option could be to use other more objective measures of meat consumption, for example by collecting shopping receipts (e.g. Kaiser, Henn & Marschke, 2020). This could help to overcome potential issues associated with self-report data in addition to high attrition rates.

Another limitation of the surveys used in this thesis relates to the use of closed-ended questions, as participant responses were limited to the options provided, meaning other potential effects might have been missed. For example, it is possible that behavioural spillover occurred for other pro-environmental behaviours which were not measured in this thesis. In hindsight, including additional qualitative methods could have been useful in aiding a greater understanding of potential spillover effects. For example, Galizzi and Whitmarsh (2019) suggest using an initial qualitative research phase to identify clusters of possible behaviours between which spillover might occur, followed by a subsequent experimental design to validate any spillover effects as well as the underlying mechanisms.

Furthermore, the spillover measure used in this thesis asked participants to indicate their intentions to perform different pro-environmental behaviours in the upcoming months. This enabled an investigation of various different types of pro-environmental behaviours that could occur due to reduced meat consumption. However, there is often a gap between people's intentions and actions (e.g. Hassan et al., 2016), meaning an increased willingness to perform different pro-environmental behaviours might not necessarily lead to pro-environmental behaviour change, or behavioural spillover. Using an objective measure of spillover therefore might have been more beneficial in establishing whether reduced meat consumption might lead to other untargeted pro-environmental behaviours. This could be addressed in future research, by drawing on observable measures of behavioural spillover that have been adopted in other studies. For example, Carrico et al. (2017) asked participants if they would like to donate some of their participant payment to an environmental organisation, while Evans et al. 2012 observed whether participants recycled a sheet of paper, as indicators of pro-environmental behavioural spillover. Using similar methods would overcome limitations associated with intention measures and self-report data, whilst providing a more concrete understanding of whether reduced meat consumption might lead to additional pro-environmental behaviours.

A strength of the randomised messaging intervention is that meat consumption was measured across different time points, to establish whether the effects of the intervention on reducing participants' red and processed meat consumption would persist after the intervention had ended. This adds to past literature which has tended to investigate intervention effects at a single time point, during or shortly after treatment (e.g. Carfora et al., 2017b; Cordts et al., 2014; Stea & Pickering, 2018). Indeed, the results supported that the randomised messaging intervention was effective in reducing participants' red and processed meat consumption during the intervention and one month later, compared to baseline. However, a limitation of this study design is that it is not possible to determine whether the intervention effects lasted beyond one month. Red and processed meat consumption was not measured beyond this point because it was not known whether the intervention would be effective in reducing participants' meat consumption in the first instance. However, future research should consider investigating intervention effects across further multiple time points, for example six and twelve months after treatment, to establish the longevity of the established effects. This could provide important information on the extent to which a short-term intervention could encourage long lasting behaviour change in relation to meat consumption, which may be of use to policymakers.

It is also a limitation that behavioural spillover was not measured beyond one month following the intervention. For example, individuals may have more opportunities to perform different pro-environmental behaviours over time, potentially increasing the likelihood of spillover occurring (i.e. over six months compared to one month). This could explain the absence of spillover detected in this thesis. Moreover, it is possible that spillover may be more likely to occur as a result of prolonged dietary change, as individuals may seek to maintain consistency between their (pro-environmental) behaviours (Truelove et al., 2014). Future research should therefore consider investigating the longevity of intervention effects on reducing participants' meat consumption, in addition to investigating the potential for spillover to occur over prolonged periods of time.

The randomised messaging intervention was implemented using a mobile phone app so that the different messages could be delivered to a large participant sample with little effort from the researcher and without participants having to come into the laboratory. Implementing the intervention in this way appeared to be effective as the intervention successfully reduced participants' red and processed meat consumption, while other studies have found that information provision does not always elicit behaviour change (e.g. Abrahamse et al., 2005). This supports the use of mobile phone apps to deliver interventions, as demonstrated in recent literature (e.g. Bertolotti et al., 2019; Carfora et al., 2017a, b; Orr & King, 2015). Implementing the intervention in this way enabled high validity, as participants were able to receive the messages in a real-life setting, for example their own homes. However, this also reduces the control over the experiment. For example, it could not be confirmed whether participants read all of the messages that were sent to them each day during the two-week intervention or at what times the different messages were read by participants. Future studies might therefore benefit from including an option for participants to confirm that they have read each message during each day of the intervention, to ensure participant engagement in the study.

While the randomised messaging intervention was effective in reducing participants' meat consumption, it is not clear how the different types of messages were received by participants. On the other hand, asking participants how convincing they found each of the different messages could have provided insight into how different types of information about meat could have been differently received by participants, and how this might have subsequently influenced their behaviour. For example, participants in each of the experimental conditions received 14 different messages highlighting different impacts of meat on either their health and/or the environment. Asking for participant feedback could have been useful in identifying which messages were the most convincing and effective in encouraging reduced meat consumption. This approach could be used in future research to establish more precisely what types of information, for example highlighting which specific health and/or environmental impacts, has the biggest effect on changing attitudes and behaviour in relation to meat consumption.

It might also be useful to investigate the implementation of informational strategies in settings such as canteens or restaurants, to establish their effects on real-life consumption and purchasing behaviours. For example, Godfrey (2014) found that providing information about the water footprint of livestock via posters in a university canteen was not effective on reducing meat purchases. On the other hand, Verfuerth et al. (2019) found that reducing the availability of meat options in a workplace canteen combined with posters communicating the environmental impacts of meat via posters, was effective in reducing subsequent meat consumption. A similar study investigating food waste in a university canteen found that providing information on food waste via posters was effective in reducing waste when participants were also offered smaller serving sizes, while providing information without reducing the offered serving sizes had no effect (Visschers, Gundlach & Beretta, 2020). Therefore, while the findings from this thesis indicate that providing information can be effective in reducing red and processed meat consumption, it is possible that other structural changes may be needed to encourage dietary change in other contexts.

The fact that participants in the control condition also reduced their consumption of red and processed meat one month after the randomised messaging intervention was an unexpected finding and possibly reflects a limitation of the study design. One explanation for this finding is that completing the food diaries led participants in the control condition to self-monitor their red and processed meat consumption, resulting in reduced meat consumption. Future research should explore this possibility by including an additional control group in which participants are not asked to complete a daily food diary, to shed light on this finding. This would also be an interesting contribution to the literature, as intervention studies which use self-monitoring as a tool to promote behaviour change often use this in conjunction with information provision or other techniques (e.g. Amiot et al., 2018; Carfora et al., 2017a). Therefore, conducting further research to separate out the effects of information provision and self-monitoring could be useful in establishing whether using self-monitoring, for example through completing a daily food diary, might be an effective strategy to reduce red and processed meat consumption in the absence of any other intervention techniques.

A limitation of the study design is that many participants were studying on the same course at the same university, meaning participants might have had the opportunity to share information about the study. This could also explain why participants in the control condition reduced their red and processed meat consumption, as participants may have identified the aims of the study and subsequently changed their behaviour as a result of social desirability. Participants were not asked whether they had discussed the study with any other participants, or whether they had guessed the aims of the study. Asking these types of questions should be adopted in future research, to reduce bias caused by information sharing and social desirability.

8.5.2 Limitations of the participant samples

Finally, the limitations of the different participant samples should be noted. First, the sample size used in the initial qualitative study was relatively small, with a greater number of participants who excluded meat from their diet (n = 14) compared to those who included meat in their diet (n = 8). It is common for qualitative research studies to have small sample sizes, given that qualitative research is concerned with providing an in-depth understanding of a phenomenon and does not focus on making generalisations beyond the research setting (see chapter 3, section 3.3). Sample sizes in qualitative research are generally determined by data saturation, which is the point at which no new information or themes are observed in the data (Guest, Bunce & Johnson, 2006). Thus, the recruitment process for the qualitative study conducted in this thesis stopped once no new ideas or themes were emerging from the data, and the sample size achieved is not dissimilar from other qualitative studies employing in-depth interviews with thematic analysis. For example, in their study on nonprobalistic sample sizes, Guest et al. (2006) found that the majority of themes (73%) could be identified in the first 6 interviews, with data saturation (93% of themes) being reached at 12 interviews. In a review of 25 in-depth interviews, Hennink, Kaiser and Marconi (2017) similarly found that saturation could be achieved within 9 interviews. However, while the sample size for the qualitative study in this thesis may have been sufficient to reach data saturation, it is possible that employing a larger sample size, particularly for the interviews with meat-eating participants, could have facilitated a greater understanding of participants' experiences. For example, although Hennink et al. (2017) found that the majority of themes could be identified within 9 interviews, they also found that that approximately 7-15 additional interviews were needed to achieve a more complete understanding of the issues identified, which they referred to as 'meaning saturation'.

Moreover the majority of participants in the initial qualitative study were female, meaning that an understanding of the experiences of males eating meat and reducing their meat consumption was not captured. This is problematic considering gender differences in meat consumption and reduction. For example, meat consumption is associated with ideas and displays of masculinity, while females are more likely than males to reduce their meat consumption and to follow a vegetarian diet (Beardsworth et al., 2002; Mertens et al., 2020; Rosenfeld, 2020; Ruby, 2012). Therefore, it is likely that the motivations for meat consumption and reduction may differ between male and female participants. For example, Lea and Worsley (2003) found that while both Australian males and females viewed enjoyment of eating meat as a main barrier towards reducing their consumption, men were more likely than women to believe that humans are supposed to eat meat. Therefore, it is a limitation of the present study that gender differences in the motivations for meat consumption and meat reduction were not captured. This could be addressed in future research, by using a larger sample size with more male participants.

The second study presented in this thesis used a convenience sample of students, meaning the findings might not be generalisable to the wider public. For example, the qualitative interviews indicated that individuals undergoing a transitional moment in their life, including moving to university, felt more capable of reducing their meat consumption. Students therefore might be more easily influenced by dietary interventions aimed at meat reduction compared to the wider population. For example, Jabs et al. (1998) found that transitions towards a meat-free diet were, for some participants, associated with enrolment on a higher educational degree. Moreover, individuals following plant-based, vegetarian and vegan diets, are more likely to be highly educated, middle or upper-middle social class and female (Salehi, 2020). Therefore, the intervention used in the quantitative study may have been more effective on reducing participants' meat consumption, given the use of a predominantly female and highly educated sample. This means that the results might not be generalisable to explain red and processed meat consumption or reduction among the general public, who may be less willing to reduce their meat consumption. Future research would therefore benefit from using more diverse participant samples to improve the generalisability of the presented findings.

8.6 Implications for research and policy aimed at meat reduction

The limitations addressed in the previous section should not undermine the contribution of this thesis in providing a greater understanding of the motives driving meat consumption and meat reduction, as well as the effectiveness of environmental, health and combined messages in reducing red and processed meat consumption and potentially encouraging additional pro-environmental behaviours. This section highlights some of the key findings presented in this thesis and the related implications for future research and policy aimed at meat reduction.

First, the results showed that meat consumption was driven by taste, health, habit and social norms, with these factors also acting as barriers towards meat reduction. Thus, these factors will need to be taken into consideration when developing strategies for meat reduction. For example, meat-free products should be promoted as being healthy and tasty, so that meat-eaters do not feel that they are compromising on these factors when deciding not to eat meat. Importantly, the findings suggest that normalising meat-free diets and the consumption of meat-free meals will be essential in encouraging meat reduction. Policymakers could consider using endorsements from celebrities and other role models to promote reduced meat-diets. Celebrities can play an important role in climate relevant consumer behaviour through social norms (Gössling, 2019), and many celebrities have previously successfully raised awareness for issues relating to animal welfare and meat consumption (see Garnett, Mathewson, Angelides & Borthwick, 2015). This could therefore provide a promising approach for reducing social pressures to consume meat and fear of social disapproval for those considering reducing their meat-consumption.

Second, the results showed that meat-eating participants tended to be unaware of the impact of meat on contributing to climate change and did not think that reducing their meat consumption would make much of a positive difference. Most meat-eating participants had also not previously considered reducing their meat consumption. This highlights the need to provide information and to communicate more clearly the significant impact of meat on contributing to climate change among the general public. The findings suggest that strategies should focus on emphasising the positive impacts that individual consumers can make, to increase self-efficacy and willingness to eat less meat. This could be done by providing personalised feedback on the positive environmental impacts achieved by reducing one's meat consumption. For example, many of the meat-free participants felt that their diet had a significant positive impact on animal welfare and on the environment, and had calculated the number of trees or animals that they had saved as a result of their diet to support this.

Third, the results showed that providing information on the different impacts of meat has the potential to encourage long-lasting behaviour change. Specifically, the results support that providing information on the environmental, health or the combined environmental and health impacts of meat can be an effective strategy for reducing red and processed meat consumption. These results support that a strong information campaign focussing on the environmental and health impacts of meat could be an important first step for policymakers to encourage dietary change. Moreover, a strong information campaign could lead to a greater acceptance of other, potentially more invasive, interventions to reduce meat consumption (Dagevos & Voordouw, 2017). Care was taken when designing the linguistic style of the messages to maximize their effect, for example by using pre-factual message styles, focussing on the benefits of meat reduction, providing different messages each day during the intervention, and using goal setting (see section 8.3). These techniques could be applied in future strategies aimed at reducing meat consumption. It should also be noted that participants were reluctant to eliminate meat from their diet entirely. Thus, policymakers should focus on encouraging individuals to reduce their meat consumption, for example by eating fewer or smaller portions of meat, rather than attempting to encourage individuals to eliminate meat from their diet completely, as such strategies are likely to be more acceptable to the public (de Boer et al., 2017).

Fourth, the successful use of Facebook messenger to deliver the randomised messaging intervention in this thesis supports that social media can be a useful intervention tool. Future research may wish to draw upon similar techniques, to deliver interventions at low cost, and with minimal effort from the researcher. Recent trends have shown an increased use of social media to deliver information and policy (Criado, Sandoval-Almazan & Gil-Garcia, 2013). Social media allows for information to reach a large audience, while analytics can provide information on how different messages are received by the public, for example by collecting data on the number of views, comments and shares a message or ‘post’ has received (Charalabidis & Loukis, 2012). Therefore, policymakers should consider the potential benefits of using social media outlets for the delivery of information campaigns aimed at reducing excess meat consumption.

Fifth, the qualitative interviews indicated that issues relating to meat do not tend to be salient at the point of purchase. Therefore, policymakers may also need to consider implementing interventions in more contextualised settings, to increase the likelihood of behaviour change. There is evidence that labelling products as being low-emission can be effective in encouraging sustainable purchasing behaviour (Vanclay et al., 2011), including shifting consumption away from animal products towards plant-based proteins (Vlaeminck, Jiang, & Vranken, 2014). Product labelling has also been used to encourage healthy eating (Kleef & Dagevos, 2015). Thus, product labelling could be a fruitful approach to making issues related to meat consumption more salient at the point of purchase, increasing the likelihood of behaviour change. Choice architecture could also be used to increase the purchase of plant-based foods, for example by encouraging a visible placement of meat-alternatives in stores and food canteens (Thorndike, Riis, Sonnenberg, & Levy, 2014).

It should be noted that different strategies towards reducing meat consumption are not mutually exclusive. Different combinations of policy and marketing strategies can be used to encourage healthier and more sustainable food choices. Indeed, a combination of different strategies may be more effective in changing dietary behaviour compared to implementing separate interventions in isolation (e.g. De Bakker & Dagevos, 2012; Nederkoorn, et al., 2011).

Sixth, the results showed that meat reduction was associated with transitional life moments, including starting a new job or moving to a new house. Previous literature has indicated that delivering an intervention during a life transition can increase its effectiveness in promoting pro-environmental behaviour (e.g. Thøgersen, 2012; Verplanken & Roy, 2015; Walker, Thomas, & Verplanken, 2015). However, research investigating the role of significant life transitions in prompting meat-free diets is sparse. There is therefore scope for further research to investigate this effect in more detail and to establish whether interventions aimed at meat reduction would also be more effective if strategically delivered during such a transition, as this could provide a promising approach to maximising the effectiveness of such interventions.

8.7 Conclusion

Using a mixed-methods approach, this thesis has shown that meat consumption is a complex behaviour driven by different factors, which can also act as barriers towards meat reduction. Many participants were not aware of the environmental impacts of meat and had not previously considered reducing their meat consumption. However, they were not reluctant to do so. In fact, providing information on the environmental and/or health impacts of meat during a two-week messaging intervention was effective in encouraging a reduced consumption of red and processed meat up to one month later. This highlights the potential for low cost informational strategies to raise awareness of the negative impact of meat on contributing to climate change and poor health, whilst encouraging long-lasting behaviour change. This thesis has also shown that strategies aimed at meat reduction may have the potential to encourage additional pro-environmental behaviours without increasing negative environmental impacts through contribution ethic or moral licencing. Thus, strategies aimed at meat reduction also have the potential to maximize positive environmental impacts, without being undermined by negative spillover effects.

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Appendices

Appendix A. Interview guide used in the initial qualitative study.

Interview Guide

Introduction

- As you know I am conducting a study on eating behaviour and I would like to thank you for agreeing to take part. We have up to 1 hour to discuss eating behavior and food choice, including the kind of foods you like to eat and why. Does that sound ok? Please know that there are no right or wrong answers, we are only interested in your own experiences and honest points of view. Please know that you do not have to answer any questions you do not want to. Are you happy to go on?

- This study is for a research project that is funded by the Economic and Social Research Council and conducted at Cardiff University. We are a team of social scientists interested in people's dietary behaviour and the kind of factors that influence what people choose to eat.

- This interview will be recorded and transcribed. Only I will have access to interview recordings, which will be stored on my personal computer. We will maintain confidentiality throughout the study, this means that the information we gather will be anonymous and any data collected cannot be traced back to you individually. You can request to have the recorded interview deleted up until transcription or anonymization.

- Do you have any questions?
- Are you happy to go on with the interview?

Demographics

Firstly we would like to ask you for some personal details,

- What is your home address? This is so that we can send payment of the study.
- Would you describe yourself as male, female or other?
- What is your age?
- How would you best describe your ethnicity?
- What do you do for a living?
- Where did you hear about this study?

Food choice motives

Next we are going to ask you some questions about the kinds of foods you eat and why

- Can you tell me about your diet? <u>Prompts</u>: What is it like? What kind of foods do you eat? What is a typical lunch / teatime meal for you?
- Why do you think you tend to eat these foods?
- Are the meals that you eat now similar to those you would have eaten when you were younger?
- Would you say that you tend to eat the same kind of things or do you often try new foods?
- Do you put a lot of thought into what food you eat, or is it more of a habit?
- When you are deciding what food to eat, what kind of things do you take into consideration?
- What would you say is the most important factor that influences your food choice? <u>Prompts</u>: Do you ever consider … the environmental impact of the food you eat, your Health, Animal Welfare, place / country of origin? What specifically do you think about …. And how does that effect your choice?
- How important would you say these factors are when deciding what foods to eat or buy?

Diet identity & restrictions

Now I'm going to ask you some questions related to your diet

- Are there any types of food or food groups that you try to avoid, or exclude completely from your diet? For example because of allergies or ethical reasons?
- What foods or food groups do you exclude and why?
- Out of the following, what label best describes your diet; omnivore, pescatarian, vegetarian, vegan, or any other label that I haven't mentioned?
- Can you explain why you have chosen this label
- How important is being a …… to you or who are? E.g. is it a big part of your identity
- What are your reasons for eating a …. diet
- Do you find eating a ….. is quite easy or difficult to do? How so?
- Have you always eaten a ….. diet ?

If no:

- how long have you eaten a … diet for?
- How did you find transitioning from ….to…..
- What were your reasons for this transition?
- Do you think you would ever go back to your previous diet

Awareness of the environmental Impacts of meat

Now I'm going to ask some questions on the different impacts that your diet might have

- Do you think your diet has any impact on the environment? In what way?
- Do you think your diet could be more environmentally friendly in anyway? How so?
- Would you be willing to change your diet if you thought it would be better for the environment? What kinds of thing do you think you would be willing to do?
- How easy or difficult do you think this would be?

- Would you say that you are an environmentally conscious person? Do you do anything to try and protect the environment?
- Who do you think is responsible for ensuring the food we eat is not environmentally damaging? Prompt: what about the government, food producers, consumers
- Is there anything you think that might make you change your diet in the future? E.g. concern for health, animal welfare, price, political views?
- What kinds of thing do you think you would be willing to do?

Motives driving meat consumption and willingness to reduce meat

So you have stated that you include meat as part of your diet, I just want to ask some questions about that

- How often do eat meals containing meat?
- Why do you eat meat?
- Is there anything about it you find particularly appealing?
- How important is it to you that the meals you eat contain meat?
- Do you ever eat meals that don't contain any meat? What are your reasons for doing / not doing this?
- Would you be willing to eat less meat if you thought it was better for your health? What if it was better for the environment? And if it was better for animal welfare? Or if it was better for other people, for example the working conditions of farmers - SKIP if already answered
- Do you ever consider the impact of eating meat on these factors?

Overall..

- Of all of the things that we have discussed today, what factors are the most important to you when deciding what kind of foods to eat?

Experience of Veganuary

- How did you first hear about veganuary?

- What motivated you to take part?
- Can you tell me about your experience of veganuary?
- Had you ever eaten vegan or vegetarian meals prior to taking part?
- How long did you take part in veganuary for?
- Did you find that it was easy or difficult to do? Why?
- Do you think you will try to incorporate more vegan or vegetarian meals in your diet now that you have taken part in veganuary?
- Do you think participating in veganuary has made you more aware in anyway?
- Do you think veganuary has impacted any of your other aspects of your life in anyway? Prompts Either related to eating or not? Do you think it has changed how you view yourself in anyway? Do you think it has made you aware of things like the environment, health, animal welfare, anything else?

Thanks for participation

- That is the end of the study, do you have any questions?
- Thank you for your participation, your payment check of £10 will reach you within a month.
- Would you be happy for us to contact you in the future with the opportunity to participate in other similar studies?

Appendix B. Final codes and themes derived from qualitative interviews.

Interviews with meat-eating participants

Motives driving meat-consumption:

- Taste preferences
- Health
    - View meat as providing essential nutrients [barrier to reduction]
- Habit [barrier to reduction]
- Upbringing
- Household consumption [barrier to reduction]
- Social norms [barrier to reduction]
    - Cultural norms and tradition (Sunday dinner)
    - Special occasions (Christmas)

Awareness of negative environmental impacts of meat:

- Some awareness
- Focus on packaging / transport
- Some links with greenhouse gases
- Uncertainty of specific impacts
- Sceptical
    - Meat-free diets are 'just as bad'
    - Lack of trust

Motives for meat reduction:

- Price
- Taste/variety
- Concern for health
- Environmental concern
- Household consumption
- Disgust towards reminders of animal origin

Willingness to eat less meat:

- Health
    - Most willing to reduce for their health
- Environment
    - Some willingness but reluctant
    - Sceptical, need to be convinced
- Animal welfare
    - Reluctant
    - Issues would need to be severe
- Welfare of workers
    - Willing
    - Issue is complex
- Prefer everything in moderation
- Willing but not doing
    - Aware of gap between attitudes and behaviour
    - Issues not salient whilst shopping for food

Perceived responsibility:

- External bodies
    - Supermarkets, food producers, government, environmental organisation
- Consumer
    - Consumers are responsible but choice is limited by supply

Interviews with meat-free participants

Motives driving meat reduction:

- Concern for animal welfare
    - Poor welfare standards
    - Don’t want to contribute to animal harm
    - Shocking footage

    - Salient link between animal origin and meat
- Meat & dairy as business
    - Sold lies
    - Not essential for healthy diet
- Wasteful industry
    - 'Freegan' diet
- Concern for health impact of meat
    - Health impacts of red meat
    - Use of antibiotics and hormones
- Health benefits reinforce meat-free diet
- Identity
    - Morals behind diet important
    - Associated with other lifestyle choices
    - Purity of motive
- Environmental issues
- Global food security

Awareness of negative environmental impacts of meat:

- Concern for environmental issues
- Links with climate change
- Links with other environmental issues
    - greenhouse gases, land use, water use
- Links with global food security
- Aware of environmental issues after becoming meat-free
    - Strong reinforcing factor for meat-free diet

Perceived responsibility:

- Consumer
    - Consumers can make a difference to change supply
    - Perceive changing own diet as having a positive impact

    - Together we can make a difference
    - Consumer choice limited by supply
- External bodies
    - Supermarkets, food producers, government, environmental organisation
    - In ‘ideal’ situation

Other factors associated with the transition to a meat-free diet:

- Someone else went vegan
- Transitional life moments
- Trailing being vegan with Veganuary

Social stigma associated with meat reduction:

- Negative stereotypes associated with meat-free diets
- Meat-free diets disrupt social norms
- Social exclusion and marginalisation

Appendix C. Information displayed to participants before the randomised messaging intervention.

1) Control:

For the next part of the study, you will be asked to record all of the food you consume by keeping a daily food diary for 14 consecutive days. You will be sent some information including a reminder and a link to the food diary each day via the private chat on Facebook messenger during this time.

We ask that you do not change your diet in anyway during the study period.

2) Health:

For the next part of the study, you will be asked to record all of the food you consume by keeping a daily food diary for 14 consecutive days. You will be sent some information including a reminder and a link to the food diary each day via the private chat on Facebook messenger during this time.

During the study period we ask that you try to eat no more than two medium portions of red (including processed) meat each week. This is because several scientific studies have shown that red/processed meat negatively affects health through an increased risk of chronic diseases including bowel, respiratory, kidney, liver and heart disease, as well as diabetes and stroke. Furthermore, red/processed meat consumption is associated with several forms of cancer, including stomach, pancreatic and bowel cancer, in addition to obesity, metabolic syndrome and joint problems. This is thought to result from the presence of harmful substances in red/processed meat and other chemicals produced through cooking. Therefore, reducing your red/processed meat consumption will protect your health.

3) Environment:

For the next part of the study, you will be asked to record all of the food you consume by keeping a daily food diary for 14 consecutive days. You will be sent some information including a reminder and a link to the food diary each day via the private chat on Facebook messenger during this time.

During the study period we ask that you try to eat no more than two medium portions of red (including processed) meat each week. This is because several scientific studies have shown that red/processed meat production negatively affects the environment through the release of harmful greenhouse gases, driving climate change. Furthermore, red/processed meat production is associated with harmful changes to land, water and air, including deforestation, soil acidification, desertification, biodiversity loss, water pollution, and air pollution. This results from the excessive amount of land, water and fertilizer that is needed to rear livestock for red/processed meat consumption. Therefore, reducing your red/processed meat consumption will protect the environment from the harmful effects of its production.

4) Combined:

For the next part of the study, you will be asked to record all of the food you consume by keeping a daily food diary for 14 consecutive days. You will be sent some information including a reminder and a link to the food diary each day via the private chat on Facebook messenger during this time.

During the study period we ask that you try to eat no more than two medium portions of red (including processed) meat each week. This is because several scientific studies have shown that red/processed meat consumption is linked to a series of negative health and environmental outcomes.

Red/processed meat negatively affects health through an increased risk of chronic diseases including bowel, respiratory, kidney, liver and heart disease, as well as diabetes and stroke. Furthermore, red/processed meat consumption is associated with several forms of cancer, including stomach, pancreatic and bowel cancer, in addition to obesity, metabolic syndrome and joint problems. This is thought to result from the presence of harmful substances in red/processed meat and other chemicals produced through cooking. Red/processed meat production negatively affects the environment through the release of harmful greenhouse gases, driving climate change. Furthermore, red/processed meat production is associated with harmful changes to land, water and air, including deforestation, soil acidification, desertification, biodiversity loss, water pollution, and air pollution. This results from the excessive amount of land, water and fertilizer that is needed to rear livestock for red/processed meat consumption. Therefore, reducing your red/processed meat consumption will protect both the environment and your health.

Appendix D. Cronbach's alpha for measures used in the quantitative surveys (study 2)

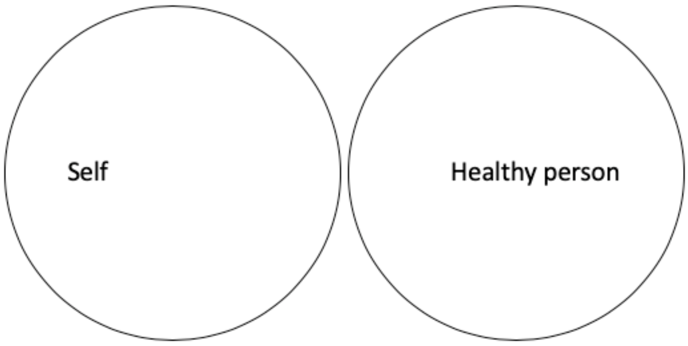
	Baseline (T1)	Shortly after Intervention (T2)	One month following intervention (T3)
Intention	0.95	0.97	0.98
Attitudes	0.80	0.83	0.86
Subjective Norms	0.79	0.77	0.82
Descriptive Norms	0.56	0.55	0.58
Self-efficacy	0.83	0.83	0.85
Perceived Behavioural Control	0.55	0.66	0.67
Decisional Balance, Perceived Benefits	0.72	0.73	0.75
Decisional Balance, Perceived Barriers	0.54	0.61	0.66
Health Identity	0.73	0.75	0.71
Meat Identity	0.75	0.75	0.82
Pro-environmental Identity	0.84	0.81	0.79
Behavioural Spillover	x	0.83	0.82
Contribution Ethic	x	0.79	0.74
Behavioural Difficulty	x	0.88	0.90

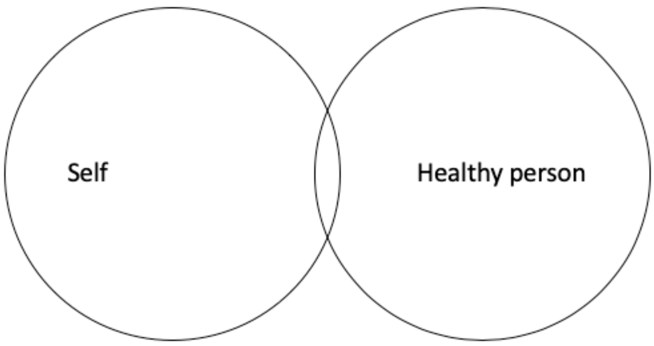
Note. Missing values are denoted by 'x'.

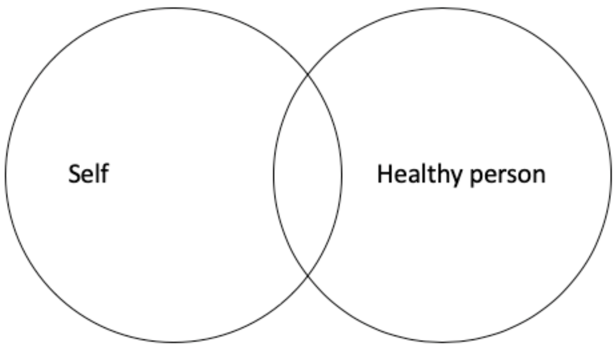
Appendix E. Visual identity measures.

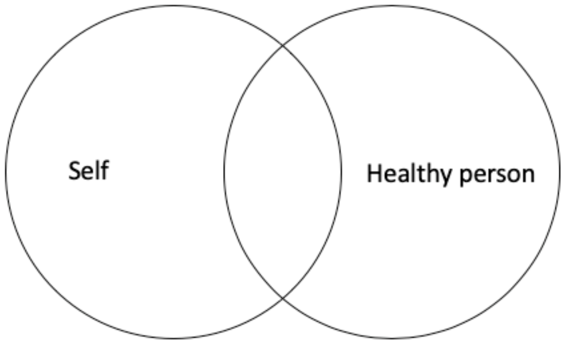
Health identity

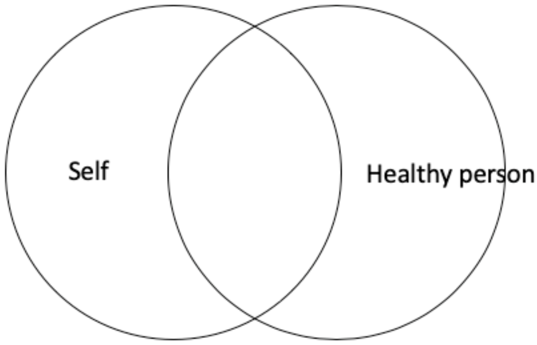
A “healthy person” is someone who tries to act in ways that are not detrimental to their health. Part of this includes buying/consuming food products that do not harm, but improve and protect one’s health. Choose the image below that best describes the degree of overlap between your personal identity and the identity of healthy person:

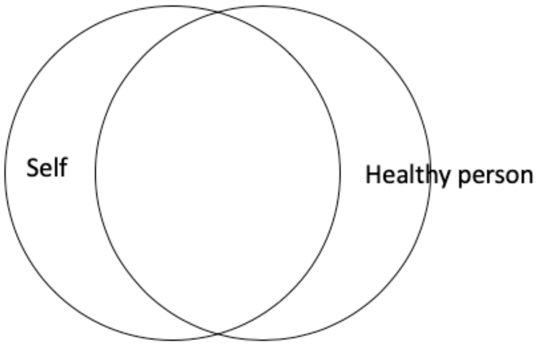


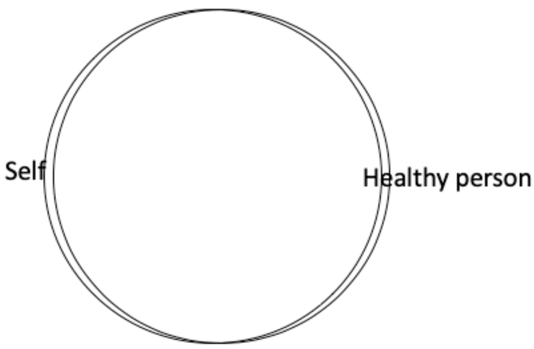





Self
Healthy person

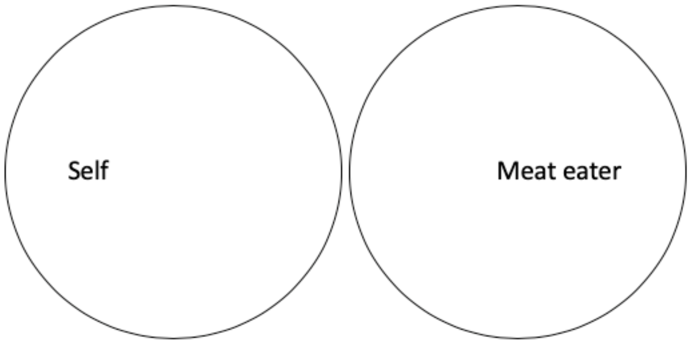

Self
Healthy person

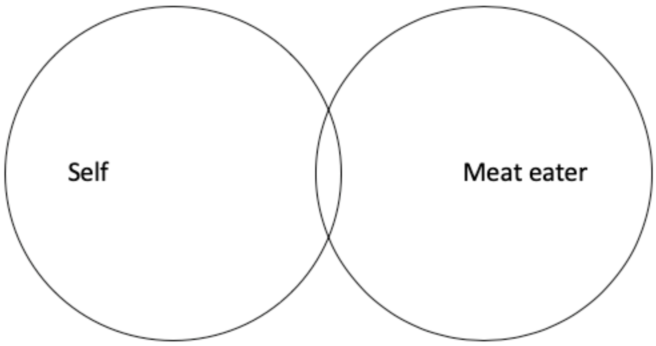

Self
Healthy person

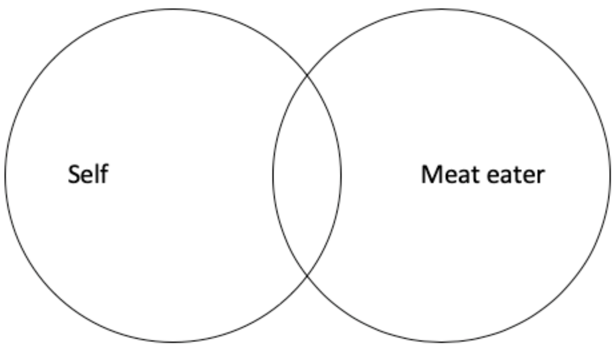

Self
Healthy person

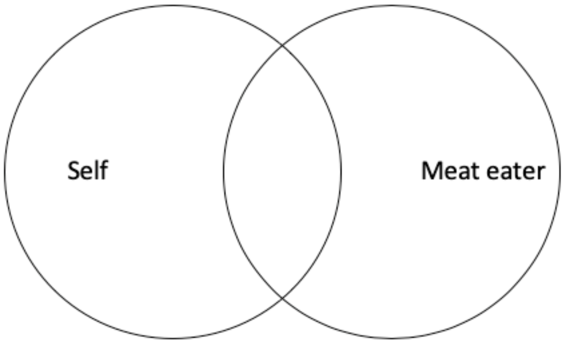
Identity as a meat-eater

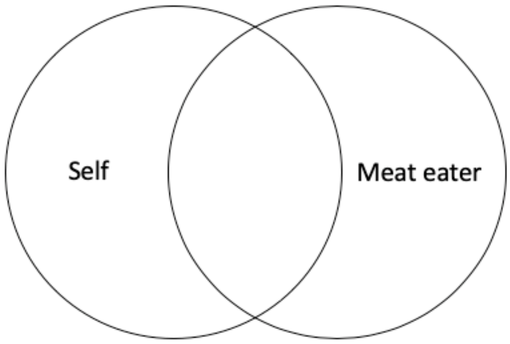
A ‘meat eater’ is someone who enjoys eating meat. Part of this includes eating meat often and perceiving this as being an important aspect that characterises one's identity. Choose the image below that best describes the degree of overlap between your personal identity and the identity of a meat eater:

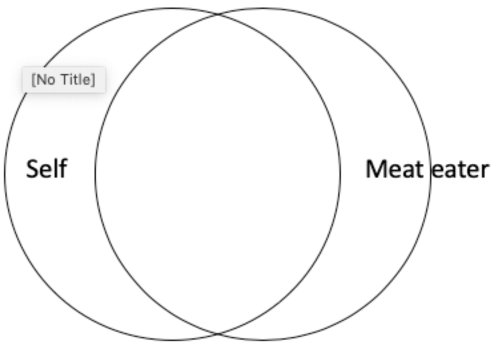


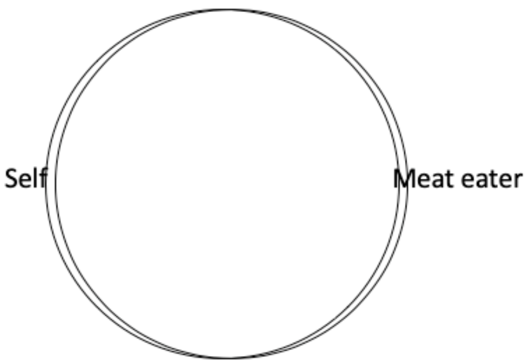





Self
Meat eater

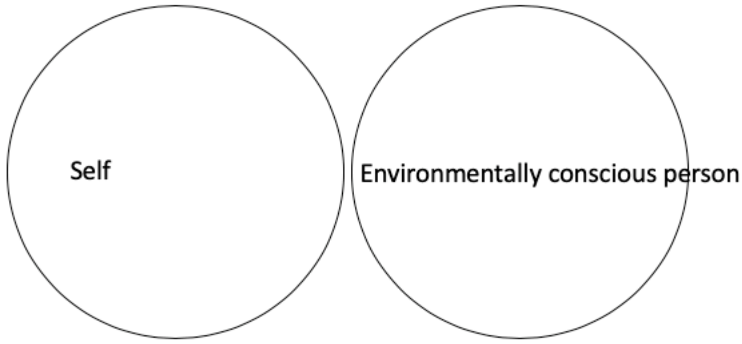

Self
Meat eater

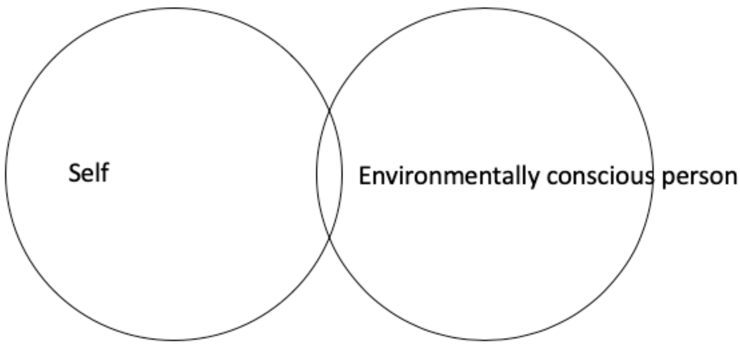

[No Title]
Self
Meat eater

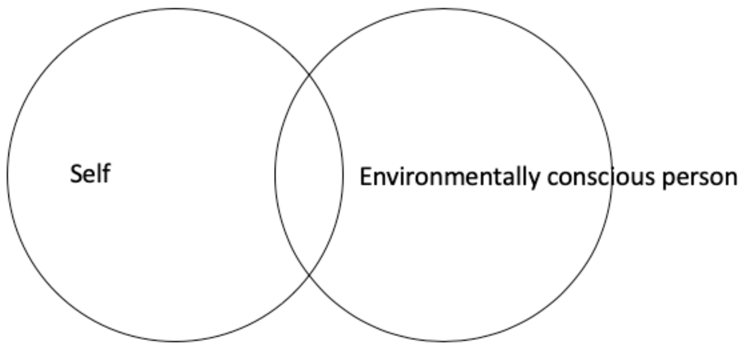

Self
Meat eater

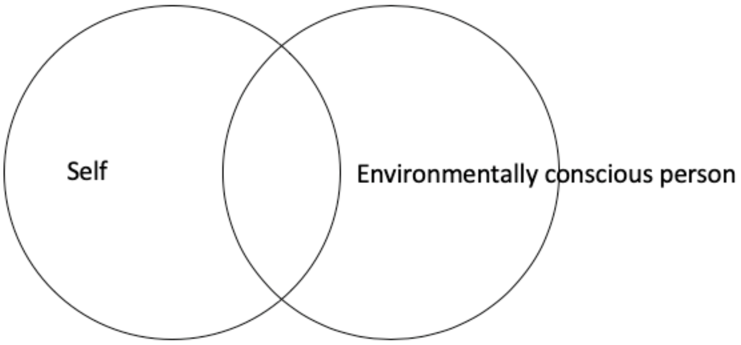
Pro-environmental identity

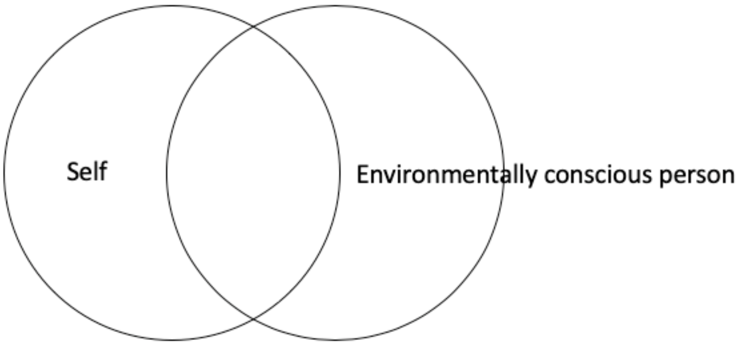
An 'environmentally conscious person' is someone who tries to act in ways that are not detrimental to the environment. Part of this includes buying/consuming food products that have little negative impact on the environment. Choose the image below that best describes the degree of overlap between your personal identity and the identity of an environmentally conscious person:

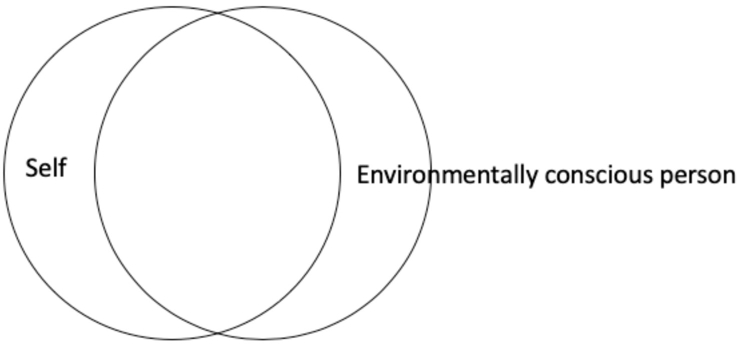


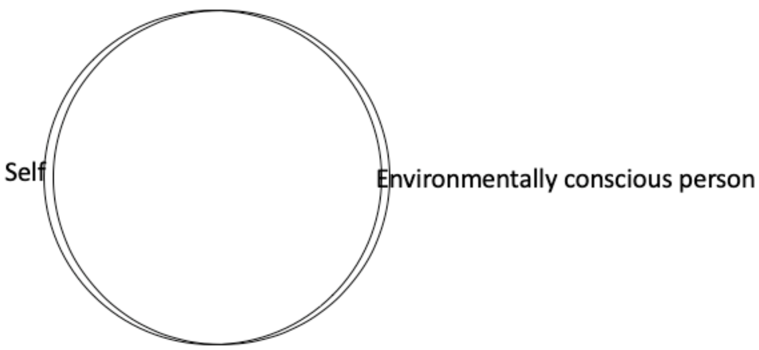





Self
Environmentally conscious person


Self
Environmentally conscious person


Self
Environmentally conscious person


Self
Environmentally conscious person

Appendix F. Messages received during the randomised messaging intervention.

Control condition	Health condition	Environment condition	Combined condition
MORNING: A link to today's food diary will be sent to you this evening so that you can record your food intake for today. That is all for now. I will write to you tonight with further instructions. EVENING: AFTER DINNER, please remember to record all of	MORNING: If you eat only a small amount of red and processed meat, you will protect your health by reducing the likelihood of developing cancer. Remember to try and eat no more than two portions of red/processed meat this week.	MORNING: If you eat only a small amount of red and processed meat, you will protect the environment by reducing the release of harmful greenhouse gases. Remember to try and eat no more than two portions of red/processed meat this week.	MORNING: If you eat only a small amount of red and processed meat, you will protect the environment from harmful greenhouse gases and you will protect your health by reducing the likelihood of developing cancer. Remember to try and eat no more than two

the food you eat today using today's food diary. Click "Go to Diary" to go to today's food diary. Please make sure you press the red arrow at the end of the diary to save your responses.	A link to today's food diary will be sent to you this evening so that you can record your food intake for today. EVENING: If you eat only a small amount of red and processed meat, you will protect your health by reducing the likelihood of developing cancer.	A link to today's food diary will be sent to you this evening so that you can record your food intake for today. EVENING: If you eat only a small amount of red and processed meat, you will protect the environment by reducing the release of harmful greenhouse gases. Remember to try and eat no more than two	portions of red/processed meat this week. A link to today's food diary will be sent to you this evening so that you can record your food intake for today. EVENING: If you eat only a small amount of red and processed meat, you will protect the environment from harmful greenhouse gases and you will protect your health by reducing

	Remember to try and eat no more than two portions of red/processed meat this week. AFTER DINNER, please remember to record all of the food you eat today using today’s food diary. Click “Go to Diary” to go to today’s food diary. Please make sure you press the red arrow at the end of the diary to save your responses.	portions of red/processed meat this week. AFTER DINNER, please remember to record all of the food you eat today using today’s food diary. Click “Go to Diary” to go to today’s food diary. Please make sure you press the red arrow at the end of the diary to save your responses.	the likelihood of developing cancer. Remember to try and eat no more than two portions of red/processed meat this week. AFTER DINNER, please remember to record all of the food you eat today using today’s food diary. Click “Go to Diary” to go to today’s food diary. Please make sure you press the red arrow at the

			end of the diary to save your responses.
MORNING: A link to today's food diary will be sent to you this evening so that you can record your food intake for today. That is all for now. I will write to you tonight with further instructions. EVENING: AFTER DINNER, please remember to record all of	MORNING: If you eat only a small amount of red and processed meat, you will protect your health by reducing the likelihood of becoming obese. Remember to try and eat no more than two portions of red/processed meat this week.	MORNING: If you eat only a small amount of red and processed meat, you will protect the environment by reducing the amount of deforestation. Remember to try and eat no more than two portions of red/processed meat this week.	MORNING: If you eat only a small amount of red and processed meat, you will protect your health by reducing the likelihood of becoming obese and you will protect the environment by reducing the amount of deforestation. Remember to try and eat no more than two

the food you eat today using today's food diary. Click "Go to Diary" to go to today's food diary. Please make sure you press the red arrow at the end of the diary to save your responses.	A link to today's food diary will be sent to you this evening so that you can record your food intake for today. EVENING: If you eat only a small amount of red and processed meat, you will protect your health by reducing the likelihood of becoming obese. Remember to try and eat no more than two portions of red/processed meat this week.	A link to today's food diary will be sent to you this evening so that you can record your food intake for today. EVENING: If you eat only a small amount of red and processed meat, you will protect the environment by reducing the amount of deforestation. Remember to try and eat no more than two	portions of red/processed meat this week. A link to today's food diary will be sent to you this evening so that you can record your food intake for today. EVENING: If you eat only a small amount of red and processed meat, you will protect your health by reducing the likelihood of becoming obese and you will protect the

	AFTER DINNER, please remember to record all of the food you eat today using today's food diary. Click "Go to Diary" to go to today's food diary. Please make sure you press the red arrow at the end of the diary to save your responses.	portions of red/processed meat this week. AFTER DINNER, please remember to record all of the food you eat today using today's food diary. Click "Go to Diary" to go to today's food diary. Please make sure you press the red arrow at the end of the diary to save your responses.	environment by reducing the amount of deforestation. Remember to try and eat no more than two portions of red/processed meat this week. AFTER DINNER, please remember to record all of the food you eat today using today's food diary. Click "Go to Diary" to go to today's food diary. Please make sure you press the red arrow at the

			end of the diary to save your responses.
MORNING: A link to today's food diary will be sent to you this evening so that you can record your food intake for today. That is all for now. I will write to you tonight with further instructions. EVENING: AFTER DINNER, please remember to record all of	MORNING: If you eat only a small amount of red and processed meat, you will protect your health by reducing the likelihood of developing heart disease. Remember to try and eat no more than two portions of red/processed meat this week. A link to today's food diary will be sent to you	MORNING: If you eat only a small amount of red and processed meat, you will protect the environment by reducing water waste. Remember to try and eat no more than two portions of red/processed meat this week. A link to today's food diary will be sent to you this evening so that you	MORNING: If you eat only a small amount of red and processed meat, you will protect the environment by reducing water waste and you will protect your health by reducing the likelihood of developing heart disease. Remember to try and eat no more than two portions of red/processed meat this week.

the food you eat today using today's food diary. Click "Go to Diary" to go to today's food diary. Please make sure you press the red arrow at the end of the diary to save your responses.	this evening so that you can record your food intake for today. EVENING: If you eat only a small amount of red and processed meat, you will protect your health by reducing the likelihood of developing heart disease. Remember to try and eat no more than two	can record your food intake for today. EVENING: If you eat only a small amount of red and processed meat, you will protect the environment by reducing water waste. Remember to try and eat no more than two portions of red/processed meat this week. AFTER DINNER, please remember to record all of	A link to today's food diary will be sent to you this evening so that you can record your food intake for today. EVENING: If you eat only a small amount of red and processed meat, you will protect the environment by reducing water waste and you will protect your health by reducing the likelihood of developing heart disease.

	portions of red/processed meat this week. AFTER DINNER, please remember to record all of the food you eat today using today’s food diary. Click “Go to Diary” to go to today’s food diary. Please make sure you press the red arrow at the end of the diary to save your responses.	the food you eat today using today’s food diary. Click “Go to Diary” to go to today’s food diary. Please make sure you press the red arrow at the end of the diary to save your responses.	Remember to try and eat no more than two portions of red/processed meat this week. AFTER DINNER, please remember to record all of the food you eat today using today’s food diary. Click “Go to Diary” to go to today’s food diary. Please make sure you press the red arrow at the end of the diary to save your responses.

MORNING: A link to today’s food diary will be sent to you this evening so that you can record your food intake for today. That is all for now. I will write to you tonight with further instructions. EVENING: AFTER DINNER, please remember to record all of the food you eat today using today’s food diary.	MORNING: If you eat only a small amount of red and processed meat, you will protect your health by reducing the likelihood of becoming diabetic. Remember to try and eat no more than two portions of red/processed meat this week. A link to today’s food diary will be sent to you this evening so that you can record your food intake for today.	MORNING: If you eat only a small amount of red and processed meat, you will protect the environment by reducing water pollution. Remember to try and eat no more than two portions of red/processed meat this week. A link to today’s food diary will be sent to you this evening so that you can record your food intake for today.	MORNING: If you eat only a small amount of red and processed meat, you will protect your health by reducing the likelihood of becoming diabetic and you will protect the environment by reducing water pollution. Remember to try and eat no more than two portions of red/processed meat this week. A link to today’s food diary will be sent to you

Click “Go to Diary” to go to today’s food diary. Please make sure you press the red arrow at the end of the diary to save your responses.	EVENING: If you eat only a small amount of red and processed meat, you will protect your health by reducing the likelihood of becoming diabetic. Remember to try and eat no more than two portions of red/processed meat this week. AFTER DINNER, please remember to record all of	EVENING: If you eat only a small amount of red and processed meat, you will protect the environment by reducing water pollution. Remember to try and eat no more than two portions of red/processed meat this week. AFTER DINNER, please remember to record all of the food you eat today using today’s food diary.	this evening so that you can record your food intake for today. ______________________ ______________________ _____ EVENING: If you eat only a small amount of red and processed meat, you will protect your health by reducing the likelihood of becoming diabetic and you will protect the environment by reducing water pollution.

	the food you eat today using today’s food diary. Click “Go to Diary” to go to today’s food diary. Please make sure you press the red arrow at the end of the diary to save your responses.	Click “Go to Diary” to go to today’s food diary. Please make sure you press the red arrow at the end of the diary to save your responses.	Remember to try and eat no more than two portions of red/processed meat this week. AFTER DINNER, please remember to record all of the food you eat today using today’s food diary. Click “Go to Diary” to go to today’s food diary. Please make sure you press the red arrow at the end of the diary to save your responses.
MORNING:	MORNING:	MORNING:	MORNING:

A link to today's food diary will be sent to you this evening so that you can record your food intake for today. That is all for now. I will write to you tonight with further instructions. EVENING: AFTER DINNER, please remember to record all of the food you eat today using today's food diary.	If you eat only a small amount of red and processed meat, you will protect your health by reducing the likelihood of developing colon cancer. Remember to try and eat no more than two portions of red/processed meat this week. A link to today's food diary will be sent to you this evening so that you can record your food intake for today.	If you eat only a small amount of red and processed meat, you will protect the environment by reducing excessive land use. Remember to try and eat no more than two portions of red/processed meat this week. A link to today's food diary will be sent to you this evening so that you can record your food intake for today.	If you eat only a small amount of red and processed meat, you will protect the environment by reducing excessive land use and you will protect your health by reducing the likelihood of developing colon cancer. Remember to try and eat no more than two portions of red/processed meat this week. A link to today's food diary will be sent to you this evening so that you

Click “Go to Diary” to go to today’s food diary. Please make sure you press the red arrow at the end of the diary to save your responses.	EVENING: If you eat only a small amount of red and processed meat, you will protect your health by reducing the likelihood of developing colon cancer. Remember to try and eat no more than two portions of red/processed meat this week. AFTER DINNER, please remember to record all of	EVENING: If you eat only a small amount of red and processed meat, you will protect the environment by reducing excessive land use. Remember to try and eat no more than two portions of red/processed meat this week. AFTER DINNER, please remember to record all of	can record your food intake for today. EVENING: If you eat only a small amount of red and processed meat, you will protect the environment by reducing excessive land use and you will protect your health by reducing the likelihood of developing colon cancer. Remember to try and eat no more than two

	the food you eat today using today’s food diary. Click “Go to Diary” to go to today’s food diary. Please make sure you press the red arrow at the end of the diary to save your responses.	the food you eat today using today’s food diary. Click “Go to Diary” to go to today’s food diary. Please make sure you press the red arrow at the end of the diary to save your responses.	portions of red/processed meat this week. AFTER DINNER, please remember to record all of the food you eat today using today’s food diary. Click “Go to Diary” to go to today’s food diary. Please make sure you press the red arrow at the end of the diary to save your responses.
MORNING: A link to today’s food diary will be sent to you	MORNING: If you eat only a small amount of red and	MORNING: If you eat only a small amount of red and	MORNING: If you eat only a small amount of red and

this evening so that you can record your food intake for today. That is all for now. I will write to you tonight with further instructions. EVENING: AFTER DINNER, please remember to record all of the food you eat today using today's food diary. Click "Go to Diary" to go to today's food diary. Please make sure you	processed meat, you will protect your health by reducing the likelihood of developing bowel cancer. Remember to try and eat no more than two portions of red/processed meat this week. A link to today's food diary will be sent to you this evening so that you can record your food intake for today.	processed meat, you will protect the environment by reducing excessive fertilizer use. Remember to try and eat no more than two portions of red/processed meat this week. A link to today's food diary will be sent to you this evening so that you can record your food intake for today.	processed meat, you will protect your health by reducing the likelihood of developing bowel cancer and you will protect the environment by reducing excessive fertilizer use. Remember to try and eat no more than two portions of red/processed meat this week. A link to today's food diary will be sent to you this evening so that you can record your food intake for today.

press the red arrow at the end of the diary to save your responses.	EVENING: If you eat only a small amount of red and processed meat, you will protect your health by reducing the likelihood of developing bowel cancer. Remember to try and eat no more than two portions of red/processed meat this week. AFTER DINNER, please remember to record all of the food you eat today using today's food diary.	EVENING: If you eat only a small amount of red and processed meat, you will protect the environment by reducing excessive fertilizer use. Remember to try and eat no more than two portions of red/processed meat this week. AFTER DINNER, please remember to record all of the food you eat today using today's food diary.	EVENING: If you eat only a small amount of red and processed meat, you will protect your health by reducing the likelihood of developing bowel cancer and you will protect the environment by reducing excessive fertilizer use. Remember to try and eat no more than two portions of red/processed meat this week.

	Click “Go to Diary” to go to today’s food diary. Please make sure you press the red arrow at the end of the diary to save your responses.	Click “Go to Diary” to go to today’s food diary. Please make sure you press the red arrow at the end of the diary to save your responses.	AFTER DINNER, please remember to record all of the food you eat today using today’s food diary. Click “Go to Diary” to go to today’s food diary. Please make sure you press the red arrow at the end of the diary to save your responses.
MORNING: A link to today’s food diary will be sent to you this evening so that you	MORNING: If you eat only a small amount of red and processed meat, you will	MORNING: If you eat only a small amount of red and processed meat, you will	MORNING: If you eat only a small amount of red and processed meat, you will

can record your food intake for today. That is all for now. I will write to you tonight with further instructions. EVENING: AFTER DINNER, please remember to record all of the food you eat today using today's food diary. Click "Go to Diary" to go to today's food diary. Please make sure you press the red arrow at the	protect your health by reducing the likelihood of developing metabolic syndrome. Remember to try and eat no more than two portions of red/processed meat this week. A link to today's food diary will be sent to you this evening so that you can record your food intake for today. EVENING:	protect the environment by reducing biodiversity loss. Remember to try and eat no more than two portions of red/processed meat this week. A link to today's food diary will be sent to you this evening so that you can record your food intake for today. EVENING:	protect the environment by reducing biodiversity loss and you will protect your health by reducing the likelihood of developing metabolic syndrome. Remember to try and eat no more than two portions of red/processed meat this week. A link to today's food diary will be sent to you this evening so that you can record your food intake for today.

end of the diary to save your responses.	If you eat only a small amount of red and processed meat, you will protect your health by reducing the likelihood of developing metabolic syndrome. Remember to try and eat no more than two portions of red/processed meat this week. AFTER DINNER, please remember to record all of the food you eat today using today's food diary.	If you eat only a small amount of red and processed meat, you will protect the environment by reducing biodiversity loss. Remember to try and eat no more than two portions of red/processed meat this week. AFTER DINNER, please remember to record all of the food you eat today using today's food diary.	EVENING: If you eat only a small amount of red and processed meat, you will protect the environment by reducing biodiversity loss and you will protect your health by reducing the likelihood of developing metabolic syndrome. Remember to try and eat no more than two portions of red/processed meat this week.

	Click “Go to Diary” to go to today’s food diary. Please make sure you press the red arrow at the end of the diary to save your responses.	Click “Go to Diary” to go to today’s food diary. Please make sure you press the red arrow at the end of the diary to save your responses.	AFTER DINNER, please remember to record all of the food you eat today using today’s food diary. Click “Go to Diary” to go to today’s food diary. Please make sure you press the red arrow at the end of the diary to save your responses.
MORNING: A link to today’s food diary will be sent to you this evening so that you	MORNING: If you eat only a small amount of red and processed meat, you will	MORNING: If you eat only a small amount of red and processed meat, you will	MORNING: If you eat only a small amount of red and processed meat, you will

can record your food intake for today. That is all for now. I will write to you tonight with further instructions. EVENING: AFTER DINNER, please remember to record all of the food you eat today using today's food diary. Click "Go to Diary" to go to today's food diary. Please make sure you press the red arrow at the	protect your health by reducing the likelihood of developing pancreatic cancer. Remember to try and eat no more than two portions of red/processed meat this week. A link to today's food diary will be sent to you this evening so that you can record your food intake for today. EVENING:	protect the environment by reducing air pollution. Remember to try and eat no more than two portions of red/processed meat this week. A link to today's food diary will be sent to you this evening so that you can record your food intake for today. EVENING: If you eat only a small amount of red and	protect your health by reducing the likelihood of developing pancreatic cancer and you will protect the environment by reducing air pollution. Remember to try and eat no more than two portions of red/processed meat this week. A link to today's food diary will be sent to you this evening so that you can record your food intake for today.

end of the diary to save your responses.	If you eat only a small amount of red and processed meat, you will protect your health by reducing the likelihood of developing pancreatic cancer. Remember to try and eat no more than two portions of red/processed meat this week. AFTER DINNER, please remember to record all of the food you eat today using today’s food diary.	processed meat, you will protect the environment by reducing air pollution. Remember to try and eat no more than two portions of red/processed meat this week. AFTER DINNER, please remember to record all of the food you eat today using today’s food diary. Click “Go to Diary” to go to today’s food diary. Please make sure you press the red arrow at the	EVENING: If you eat only a small amount of red and processed meat, you will protect your health by reducing the likelihood of developing pancreatic cancer and you will protect the environment by reducing air pollution. Remember to try and eat no more than two portions of red/processed meat this week. AFTER DINNER, please remember to record all of

	Click “Go to Diary” to go to today’s food diary. Please make sure you press the red arrow at the end of the diary to save your responses.	end of the diary to save your responses.	the food you eat today using today’s food diary. Click “Go to Diary” to go to today’s food diary. Please make sure you press the red arrow at the end of the diary to save your responses.
MORNING: A link to today’s food diary will be sent to you this evening so that you can record your food intake for today.	MORNING: If you eat only a small amount of red and processed meat, you will protect your health by reducing the likelihood of developing stomach cancer.	MORNING: If you eat only a small amount of red and processed meat, you will protect the environment by reducing desertification.	MORNING: If you eat only a small amount of red and processed meat, you will protect the environment by reducing desertification and you will protect your health

That is all for now. I will write to you tonight with further instructions. EVENING: AFTER DINNER, please remember to record all of the food you eat today using today's food diary. Click "Go to Diary" to go to today's food diary. Please make sure you press the red arrow at the end of the diary to save your responses.	Remember to try and eat no more than two portions of red/processed meat this week. A link to today's food diary will be sent to you this evening so that you can record your food intake for today. EVENING: If you eat only a small amount of red and processed meat, you will	Remember to try and eat no more than two portions of red/processed meat this week. A link to today's food diary will be sent to you this evening so that you can record your food intake for today. EVENING: If you eat only a small amount of red and processed meat, you will protect the environment	by reducing the likelihood of developing stomach cancer. Remember to try and eat no more than two portions of red/processed meat this week. A link to today's food diary will be sent to you this evening so that you can record your food intake for today. EVENING:

	protect your health by reducing the likelihood of developing stomach cancer. Remember to try and eat no more than two portions of red/processed meat this week. AFTER DINNER, please remember to record all of the food you eat today using today's food diary. Click "Go to Diary" to go to today's food diary. Please make sure you	by reducing desertification. Remember to try and eat no more than two portions of red/processed meat this week. AFTER DINNER, please remember to record all of the food you eat today using today's food diary. Click "Go to Diary" to go to today's food diary. Please make sure you press the red arrow at the	If you eat only a small amount of red and processed meat, you will protect the environment by reducing desertification and you will protect your health by reducing the likelihood of developing stomach cancer. Remember to try and eat no more than two portions of red/processed meat this week. AFTER DINNER, please remember to record all of

	press the red arrow at the end of the diary to save your responses.	end of the diary to save your responses.	the food you eat today using today's food diary. Click "Go to Diary" to go to today's food diary. Please make sure you press the red arrow at the end of the diary to save your responses.
MORNING: A link to today's food diary will be sent to you this evening so that you can record your food intake for today.	MORNING: If you eat only a small amount of red and processed meat, you will protect your health by reducing the likelihood of having a stroke.	MORNING: If you eat only a small amount of red and processed meat, you will protect the environment by reducing land degradation.	MORNING: If you eat only a small amount of red and processed meat you will protect your health by reducing the likelihood of having a stroke and you will protect the

That is all for now. I will write to you tonight with further instructions. EVENING: AFTER DINNER, please remember to record all of the food you eat today using today's food diary. Click "Go to Diary" to go to today's food diary. Please make sure you press the red arrow at the end of the diary to save your responses.	Remember to try and eat no more than two portions of red/processed meat this week. A link to today's food diary will be sent to you this evening so that you can record your food intake for today. EVENING: If you eat only a small amount of red and processed meat, you will	Remember to try and eat no more than two portions of red/processed meat this week. A link to today's food diary will be sent to you this evening so that you can record your food intake for today. EVENING: If you eat only a small amount of red and processed meat, you will protect the environment	environment by reducing land degradation. Remember to try and eat no more than two portions of red/processed meat this week. A link to today's food diary will be sent to you this evening so that you can record your food intake for today. EVENING:

	protect your health by reducing the likelihood of having a stroke. Remember to try and eat no more than two portions of red/processed meat this week. AFTER DINNER, please remember to record all of the food you eat today using today's food diary. Click “Go to Diary” to go to today's food diary. Please make sure you press the red arrow at the	by reducing land degradation. Remember to try and eat no more than two portions of red/processed meat this week. AFTER DINNER, please remember to record all of the food you eat today using today's food diary. Click “Go to Diary” to go to today's food diary. Please make sure you press the red arrow at the	If you eat only a small amount of red and processed meat you will protect your health by reducing the likelihood of having a stroke and you will protect the environment by reducing land degradation. Remember to try and eat no more than two portions of red/processed meat this week. AFTER DINNER, please remember to record all of

	end of the diary to save your responses.	end of the diary to save your responses.	the food you eat today using today’s food diary. Click “Go to Diary” to go to today’s food diary. Please make sure you press the red arrow at the end of the diary to save your responses.
MORNING: A link to today’s food diary will be sent to you this evening so that you can record your food intake for today.	MORNING: If you eat only a small amount of red and processed meat, you will protect your health by reducing the likelihood of developing liver disease.	MORNING: If you eat only a small amount of red and processed meat, you will protect the environment by reducing climate change.	MORNING: If you eat only a small amount of red and processed meat, you will protect the environment by reducing climate change and you will

That is all for now. I will write to you tonight with further instructions. EVENING: AFTER DINNER, please remember to record all of the food you eat today using today's food diary. Click "Go to Diary" to go to today's food diary. Please make sure you press the red arrow at the end of the diary to save your responses.	Remember to try and eat no more than two portions of red/processed meat this week. A link to today's food diary will be sent to you this evening so that you can record your food intake for today. EVENING: If you eat only a small amount of red and processed meat, you will protect your health by	Remember to try and eat no more than two portions of red/processed meat this week. A link to today's food diary will be sent to you this evening so that you can record your food intake for today. EVENING: If you eat only a small amount of red and processed meat, you will protect the environment	protect your health by reducing the likelihood of developing liver disease. Remember to try and eat no more than two portions of red/processed meat this week. A link to today's food diary will be sent to you this evening so that you can record your food intake for today. EVENING:

	reducing the likelihood of developing liver disease. Remember to try and eat no more than two portions of red/processed meat this week. AFTER DINNER, please remember to record all of the food you eat today using today's food diary. Click "Go to Diary" to go to today's food diary. Please make sure you press the red arrow at the	by reducing climate change. Remember to try and eat no more than two portions of red/processed meat this week. AFTER DINNER, please remember to record all of the food you eat today using today's food diary. Click "Go to Diary" to go to today's food diary. Please make sure you press the red arrow at the	If you eat only a small amount of red and processed meat, you will protect the environment by reducing climate change and you will protect your health by reducing the likelihood of developing liver disease. Remember to try and eat no more than two portions of red/processed meat this week. AFTER DINNER, please remember to record all of

	end of the diary to save your responses.	end of the diary to save your responses.	the food you eat today using today's food diary. Click "Go to Diary" to go to today's food diary. Please make sure you press the red arrow at the end of the diary to save your responses.
MORNING: A link to today's food diary will be sent to you this evening so that you can record your food intake for today.	MORNING: If you eat only a small amount of red and processed meat, you will protect your health by reducing the likelihood of	MORNING: If you eat only a small amount of red and processed meat, you will protect the environment	MORNING: If you eat only a small amount of red and processed meat, you will protect your health by reducing the likelihood of

That is all for now. I will write to you tonight with further instructions. EVENING: AFTER DINNER, please remember to record all of the food you eat today using today's food diary. Click "Go to Diary" to go to today's food diary. Please make sure you press the red arrow at the end of the diary to save your responses.	developing respiratory disease. Remember to try and eat no more than two portions of red/processed meat this week. A link to today's food diary will be sent to you this evening so that you can record your food intake for today. EVENING:	by reducing soil acidification. Remember to try and eat no more than two portions of red/processed meat this week. A link to today's food diary will be sent to you this evening so that you can record your food intake for today. EVENING:	developing respiratory disease and you will protect the environment by reducing soil acidification. Remember to try and eat no more than two portions of red/processed meat this week. A link to today's food diary will be sent to you this evening so that you can record your food intake for today.

	If you eat only a small amount of red and processed meat, you will protect your health by reducing the likelihood of developing respiratory disease. Remember to try and eat no more than two portions of red/processed meat this week. AFTER DINNER, please remember to record all of the food you eat today using today's food diary.	If you eat only a small amount of red and processed meat, you will protect the environment by reducing soil acidification. Remember to try and eat no more than two portions of red/processed meat this week. AFTER DINNER, please remember to record all of the food you eat today using today's food diary.	EVENING: If you eat only a small amount of red and processed meat, you will protect your health by reducing the likelihood of developing respiratory disease and you will protect the environment by reducing soil acidification. Remember to try and eat no more than two portions of red/processed meat this week.

	Click “Go to Diary” to go to today’s food diary. Please make sure you press the red arrow at the end of the diary to save your responses.	Click “Go to Diary” to go to today’s food diary. Please make sure you press the red arrow at the end of the diary to save your responses.	AFTER DINNER, please remember to record all of the food you eat today using today’s food diary. Click “Go to Diary” to go to today’s food diary. Please make sure you press the red arrow at the end of the diary to save your responses.
MORNING: A link to today’s food diary will be sent to you this evening so that you can record your food intake for today.	MORNING: If you eat only a small amount of red and processed meat, you will protect your health by reducing the likelihood of	MORNING: If you eat only a small amount of red and processed meat, you will protect the environment	MORNING: If you eat only a small amount of red and processed meat, you will protect the environment by reducing harmful

That is all for now. I will write to you tonight with further instructions. EVENING: AFTER DINNER, please remember to record all of the food you eat today using today's food diary. Click "Go to Diary" to go to today's food diary. Please make sure you press the red arrow at the end of the diary to save your responses.	developing kidney disease. Remember to try and eat no more than two portions of red/processed meat this week. A link to today's food diary will be sent to you this evening so that you can record your food intake for today. EVENING:	by reducing harmful changes to soil and land. Remember to try and eat no more than two portions of red/processed meat this week. A link to today's food diary will be sent to you this evening so that you can record your food intake for today. EVENING:	changes to soil and land and you will protect your health by reducing the likelihood of developing kidney disease. Remember to try and eat no more than two portions of red/processed meat this week. A link to today's food diary will be sent to you this evening so that you can record your food intake for today.

	If you eat only a small amount of red and processed meat, you will protect your health by reducing the likelihood of developing kidney disease. Remember to try and eat no more than two portions of red/processed meat this week. AFTER DINNER, please remember to record all of the food you eat today using today’s food diary.	If you eat only a small amount of red and processed meat, you will protect the environment by reducing harmful changes to soil and land. Remember to try and eat no more than two portions of red/processed meat this week. AFTER DINNER, please remember to record all of the food you eat today using today’s food diary.	EVENING: If you eat only a small amount of red and processed meat, you will protect the environment by reducing harmful changes to soil and land and you will protect your health by reducing the likelihood of developing kidney disease. Remember to try and eat no more than two portions of red/processed meat this week.

	Click “Go to Diary” to go to today’s food diary. Please make sure you press the red arrow at the end of the diary to save your responses.	Click “Go to Diary” to go to today’s food diary. Please make sure you press the red arrow at the end of the diary to save your responses.	AFTER DINNER, please remember to record all of the food you eat today using today’s food diary. Click “Go to Diary” to go to today’s food diary. Please make sure you press the red arrow at the end of the diary to save your responses.
MORNING: A link to today’s food diary will be sent to you this evening so that you	MORNING: If you eat only a small amount of red and processed meat, you will protect your health by	MORNING: If you eat only a small amount of red and processed meat, you will protect the environment	MORNING: If you eat only a small amount of red and processed meat, you will protect your health by

can record your food intake for today. That is all for now. I will write to you tonight with further instructions. EVENING: AFTER DINNER, please remember to record all of the food you eat today using today's food diary. Click "Go to Diary" to go to today's food diary. Please make sure you press the red arrow at the	reducing the likelihood of developing infections. Remember to try and eat no more than two portions of red/processed meat this week. A link to today's food diary will be sent to you this evening so that you can record your food intake for today. EVENING:	by reducing the presence of microorganisms and dust in the air. Remember to try and eat no more than two portions of red/processed meat this week. A link to today's food diary will be sent to you this evening so that you can record your food intake for today. EVENING:	reducing the likelihood of developing infections and you will protect the environment by reducing the presence of microorganisms and dust in the air. Remember to try and eat no more than two portions of red/processed meat this week. A link to today's food diary will be sent to you this evening so that you

end of the diary to save your responses.	If you eat only a small amount of red and processed meat, you will protect your health by reducing the likelihood of developing infections. Remember to try and eat no more than two portions of red/processed meat this week. AFTER DINNER, please remember to record all of the food you eat today using today's food diary.	If you eat only a small amount of red and processed meat, you will protect the environment by reducing the presence of microorganisms and dust in the air. Remember to try and eat no more than two portions of red/processed meat this week. AFTER DINNER, please remember to record all of the food you eat today using today's food diary.	can record your food intake for today. EVENING: If you eat only a small amount of red and processed meat, you will protect your health by reducing the likelihood of developing infections and you will protect the environment by reducing the presence of microorganisms and dust in the air. Remember to try and eat no more than two

	Click “Go to Diary” to go to today’s food diary. Please make sure you press the red arrow at the end of the diary to save your responses.	Click “Go to Diary” to go to today’s food diary. Please make sure you press the red arrow at the end of the diary to save your responses.	portions of red/processed meat this week. AFTER DINNER, please remember to record all of the food you eat today using today’s food diary. Click “Go to Diary” to go to today’s food diary. Please make sure you press the red arrow at the end of the diary to save your responses.

Appendix G. Participant demographics across the different study conditions.

	Control			Health			Environment			Combined		
	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3
Age	M = 20 SD = 2.09	M = 20 SD = 2.00	M = 20 SD = 1.85	M = 20 SD = 3.30	M = 20 SD = 3.64	M = 20 SD = 2.20	M = 20 SD = 1.92	M = 20 SD = 1.93	M = 20 SD = 2.02	M = 20 SD = 1.77	M = 20 SD = 1.76	M = 20 SD = 1.67
Gender												
Male	N = 18	N = 16	N = 15	N= 16	N = 9	N = 11	N = 15	N = 12	N = 12	N = 10	N = 8	N = 8
Female	N = 55	N = 41	N = 37	N = 62	N = 49	N = 45	N = 68	N = 55	N = 55	N = 75	N = 60	N = 54
Level of study												
Undergraduate	N = 64	N = 49	N = 45	N = 73	N = 55	N = 53	N = 76	N = 60	N = 61	N = 80	N = 65	N = 58
Postgraduate	N = 9	N = 8	N = 7	N = 5	N = 3	N = 3	N = 7	N = 7	N = 6	N = 6	N = 4	N = 5
Prepares own meals												
Yes	N = 70	N = 55	N = 50	N = 73	N = 54	N = 51	N = 83	N = 66	N = 66	N = 83	N = 66	N = 61
No	N = 3	N = 2	N = 2	N = 5	N = 4	N = 5	N = 3	N = 1	N = 1	N = 3	N = 3	N = 2

Appendix H. Descriptive statistics for main study variables across study conditions.

	Control			Health			Environment			Combined		
	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3
TTM												
Stage of change												
Precontemplation	N = 31	N = 26	N = 20	N = 30	N = 15	N = 22	N = 35	N = 16	N = 18	N = 35	N = 13	N = 17
Contemplation	N =12	N = 9	N = 12	N = 13	N = 13	N = 10	N =10	N = 12	N = 6	N = 14	N = 13	N = 7
Preparation	N = 21	N = 16	N = 9	N = 25	N = 14	N = 13	N = 21	N = 21	N = 21	N = 25	N = 23	N = 22
Action	N = 9	N = 6	N = 11	N = 10	N = 16	N = 11	N = 17	N = 18	N = 22	N = 12	N = 20	N = 17
Self-efficacy	M = 5.01	M = 4.96	M = 4.90	M = 5.00	M = 4.93	M =4.80	M = 5.22	M = 5.15	M = 5.16	M = 5.02	M =5.02	M = 5.06
	SD = 1.28	SD = 1.14	SD = 1.44	SD = 1.67	SD = 1.33	SD = 1.34	SD = 1.19	SD = 1.06	SD = 0.97	SD = 1.05	SD = 1.21	SD = 1.15

Decisional balance												
Decisional balance pros	M = 4.38 SD = 0.58	M = 4.78 SD = 1.15	M = 4.82 SD = 1.20	M = 4.33 SD = 0.47	M = 5.05 SD = 0.93	M = 4.83 SD = 1.10	M = 4.45 SD = 0.44	M = 5.08 SD = 1.04	M = 5.16 SD = 0.92	M = 4.39 SD = 0.55	M = 5.13 SD = 0.90	M = 5.23 SD = 0.89
Decisional balance cons	M = 3.79 SD = 1.03	M = 3.88 SD = 0.92	M = 3.90 SD = 1.08	M = 3.77 SD = 1.02	M =3.76 SD = 1.02	M =4.02 SD = 1.03	M = 3.94 SD = 0.93	M = 3.70 SD = 1.02	M = 3.79 SD = 1.02	M = 3.92 SD = 0.83	M = 3.66 SD = 1.07	M = 3.70 SD = 1.11
TPB												
Attitudes	M = 4.78 SD = 0.95	M = 4.91 SD = 0.92	M = 5.00 SD = 0.93	M = 4.77 SD = 0.93	M = 5.06 SD = 092	M = 4.96 SD = 0.97	M = 4.91 SD = 0.92	M = 5.17 SD = 0.95	M = 5.19 SD = 0.89	M = 4.83 SD = 0.83	M = 5.18 SD = 0.90	M = 5.14 SD = 1.01
Subjective norms	M = 3.39 SD = 1.17	M = 3.29 SD = 1.32	M = 3.36 SD = 1.52	M = 3.4 SD = 1.39	M = 3.51 SD = 1.12	M = 3.48 SD = 1.24	M = 3.31 SD = 1.17	M = 3.49 SD = 1.08	M = 3.62 SD = 1.15	M = 3.43 SD = 1.04	M = 3.57 SD = 1.24	M = 3.82 SD = 1.29
Descriptive norms	M = 3.80 SD = 1.11	M = 3.89 SD = 1.07	M = 3.99 SD = 1.08	M = 4.10 SD = 1.26	M = 4.11 SD = 1.10	M = 4.04 SD = 1.37	M = 4.16 SD = 1.12	M = 4.22 SD = 1.03	M = 4.37 SD = 1.03	M = 3.98 SD = 0.99	M = 4.20 SD = 1.18	M = 4.06 SD = 1.20
Perceived behavioural control	M = 5.77 SD = 0.99	M = 5.59 SD = 1.07	M = 5.57 SD = 1.17	M = 5.60 SD = 0.88	M = 5.67 SD = 0.86	M = 5.61 SD = 0.85	M = 5.87 SD = 0.82	M = 5.80 SD = 0.89	M = 5.74 SD = 0.91	M = 5.58 SD = 0.89	M = 5.56 SD = 1.07	M = 5.59 SD = 0.95

Intentions	M = 3.90	M = 3.92	M = 3.87	M = 3.88	M = 4.39	M = 4.14	M = 3.98	M = 4.60	M = 4.62	M = 3.95	M = 4.85	M = 4.91
	SD = 1.65	SD = 1.81	SD = 1.77	SD = 1.50	SD = 1.66	SD = 1.56	SD = 1.64	SD = 1.42	SD = 1.35	SD = 1.53	SD = 1.24	SD = 1.48
Identity												
Pro-environmental identity	M = 4.71	M = 4.84	M = 4.92	M = 4.52	M = 4.64	M = 4.70	M = 4.43	M = 4.50	M = 4.45	M = 4.51	M = 4.60	M = 4.75
	SD = 1.05	SD = 1.06	SD = 1.04	SD = 1.17	SD = 1.06	SD = 1.06	SD = .867	SD = 0.91	SD = 0.93	SD = 1.05	SD = 0.97	SD = 0.95
Health identity	M = 4.67	M = 4.62	M = 4.84	M = 4.38	M = 4.52	M = 4.64	M = 4.56	M = 4.45	M = 4.64	M = 4.42	M = 4.50	M = 4.67
	SD = 0.84	SD = 0.87	SD = 0.83	SD =1.12	SD = 1.05	SD = 0.77	SD = 0.93	SD = 0.90	SD = 0.91	SD = 1.13	SD = 0.96	SD = 0.95
Meat-eater identity	M = 5.08	M = 4.99	M = 4.99	M = 4.92	M = 4.86	M = 4.81	M = 4.83	M = 4.33	M = 4.32	M = 5.02	M = 4.71	M = 4.70
	SD = 1.12	SD = 1.12	SD = 1.26	SD = 1.36	SD = 1.27	SD = 1.21	SD = 1.28	SD = 1.23	SD = 1.25	SD = 1.18	SD = 1.24	SD = 1.34
Meat consumption (survey data)												
White meat	M = 3.88	M = 3.91	M = 3.31	M = 4.78	M = 4.28	M = 4.18	M = 4.18	M = 4.28	M = 3.31	M = 4.07	M = 4.62	M = 3.51
	SD = 1.97	SD = 2.05	SD = 1.88	SD = 2.49	SD = 2.29	SD = 2.57	SD = 2.25	SD = 2.57	SD = 2.38	SD = 2.00	SD = 1.89	SD = 2.15
Red meat	M = 4.07	M = 4.12	M = 2.62	M = 4.40	M = 2.48	M = 2.63	M = 4.05	M = 2.30	M = 2.10	M = 4.26	M = 2.45	M = 2.16
	SD = 1.44	SD = 2.15	SD = 1.87	SD = 1.94	SD = 1.83	SD = 1.86	SD = 1.59	SD = 1.54	SD = 2.11	SD = 1.89	SD = 1.80	SD = 1.64

Processed meat	M = 2.96 SD = 2.13	M = 3.32 SD = 2.30	M = 2.50 SD = 1.89	M = 3.19 SD = 2.37	M = 2.21 SD = 2.36	M = 2.00 SD = 1.54	M = 2.96 SD = 2.31	M = 1.82 SD = 2.03	M = 1.81 SD = 1.65	M = 3.09 SD = 2.29	M = 1.91 SD = 1.87	M = 1.49 SD = 1.34
Red and processed meat consumption	M = 7.03 SD = 3.23	M = 7.44 SD = 3.91	M = 5.12 SD = 3.18	M = 7.59 SD = 3.57	M = 4.69 SD = 3.90	M = 4.63 SD = 2.88	M = 7.01 SD = 3.25	M = 4.12 SD = 3.00	M = 3.91 SD = 3.21	M = 7.35 SD = 3.66	M = 4.36 SD = 3.15	M = 3.65 SD = 2.62
Behavioural Spillover												
Willingness to perform other pro-environmental behaviours												
Have shorter showers or infrequent baths	x	M = 4.63 SD = 2.15	M = 4.49 SD = 2.17	x	M = 4.81 SD = 2.31	M = 4.84 SD = 2.03	x	M = 4.29 SD = 2.10	M = 4.13 SD = 1.93	x	M = 4.59 SD = 1.97	M = 4.85 SD = 2.11
Purchase an eco-friendly product	x	M = 4.00 SD = 1.98	M = 3.76 SD = 1.73	x	M = 4.10 SD = 2.08	M = 3.73 SD = 1.81	x	M = 3.77 SD = 1.79	M = 3.43 SD = 1.55	x	M = 4.03 SD = 1.72	M = 3.95 SD = 1.83
Buy a product with less packaging	x	M = 5.05 SD = 2.05	M = 4.49 SD = 1.95	x	M = 4.91 SD = 1.95	M = 4.62 SD = 2.01	x	M = 4.32 SD = 1.74	M = 4.25 SD = 1.80	x	M = 4.64 SD = 1.80	M = 4.52 SD = 1.74

Buy organic food produce	x	M = 3.80 SD = 2.04	M = 3.37 SD = 2.07	x	M = 3.26 SD = 1.93	M = 3.22 SD = 1.85	x	M = 3.42 SD = 2.08	M = 3.06 SD = 1.73	x	M = 3.88 SD = 1.91	M = 3.73 SD = 2.04
Buy local rather than imported food produce	x	M = 4.02 SD = 2.03	M = 3.63 SD = 2.03	x	M = 4.28 SD = 2.01	M = 3.89 SD = 1.95	x	M = 3.97 SD = 1.89	M = 3.57 SD = 1.51	x	M = 4.12 SD = 1.97	M = 3.90 SD = 1.79
Eat seasonal fruit and vegetables	x	M = 4.77 SD = 1.91	M = 4.71 SD = 1.92	x	M = 4.91 SD = 1.87	M = 4.45 SD = 1.85	x	M = 4.58 SD = 1.63	M = 4.52 SD = 1.87	x	M = 4.87 SD = 1.60	M = 4.95 SD = 1.68
Reduce consumption of meat and dairy products	x	M =3.50 SD = 2.07	M = 3.14 SD = 1.77	x	M = 4.09 SD = 1.98	M = 3.51 SD = 2.01	x	M = 4.17 SD = 1.87	M = 4.22 SD = 1.80	x	M = 3.96 SD = 1.73	M = 4.35 SD = 2.04
Use public transport instead of driving my car	x	M = 5.52 SD = 2.15	M = 5.08 SD = 2.39	x	M = 5.24 SD = 3.00	M = 5.29 SD = 2.13	x	M = 4.91 SD = 2.30	M = 4.85 SD = 2.13	x	M = 5.59 SD = 1.86	M = 4.97 SD = 2.14
Volunteer for environmental group	x	M = 1.77 SD = 1.44	M = 1.57 SD = 2.00	x	M = 1.97 SD = 1.53	M = 1.65 SD = 1.31	x	M = 1.89 SD = 1.35	M = 1.70 SD = 1.14	x	M = 1.96 SD = 1.50	M = 1.79 SD = 1.21

Donate to an environmental group	x	M = 1.82 SD = 1.32	M = 1.59 SD = 0.93	x	M = 2.12 SD = 1.48	M = 1.65 SD = 0.87	x	M = 1.91 SD = 1.27	M = 1.67 SD = 1.04	x	M = 1.97 SD = 1.27	M = 1.93 SD = 1.32
Contribution ethic	x	M = 3.90 SD = 0.94	M = 3.77 SD = 0.96	x	M = 3.82 SD = 1.07	M = 3.68 SD = 0.90	x	M = 3.61 SD = 0.89	M = 3.53 SD = 0.89	x	M = 3.69 SD = 0.86	M = 3.83 SD = 0.82
Behavioural difficulty	x	M = 3.96 SD = 1.39	M = 4.29 SD = 1.39	x	M = 3.79 SD = 1.35	M = 3.96 SD = 1.43	x	M = 3.46 SD = 1.35	M = 3.55 SD = 1.36	x	M = 3.80 SD = 1.19	M = 3.90 SD = 1.28

Appendix I. Correlation coefficients for white, red and processed meat.

	1	2	3	4	5	6	7	8	9	Mean	Standard deviation
1. White meat T1	-									4.23	2.20
2. Red meat T1	.265**	-								4.19	1.73
3. Processed meat T1	.227**	.459**	-							3.05	2.27
4. White meat T2	.352**	.226**	.142*	-						4.29	2.29
5. Red meat T2	.109	.181**	.142*	.134*	-					2.8	1.96
6. Processed meat T2	.150*	.142*	.244**	.150*	.581**	-				2.27	2.20
7. White meat T3	.396**	.209**	.131*	.440**	.167*	.216**	-			3.57	2.28
8. Red meat T3	.101	.335**	.151*	.214**	.307**	.207**	.422**	-		2.35	1.89
9. Processed meat T3	.083	.168**	.264**	.184**	.236**	.414**	.327**	.461**	-	1.92	1.64

Note. * $p < 0.05$, ** $p < 0.01$.
T1 = Time 1, T2 = Time 2, T3 = Time 3.

Appendix J. Descriptive statistics from the food diaries across the study conditions.

		Day													
	Number of portions	1 % (N)	2 % (N)	3 % (N)	4 % (N)	5 % (N)	6 % (N)	7 % (N)	8 % (N)	9 % (N)	10 % (N)	11 % (N)	12 % (N)	13 % (N)	14 % (N)
Red/Processed Meat															
Control	0	56% (N = 40)	56% (N = 36)	57% (N = 36)	53% (N = 32)	57% (N = 34)	55% (N = 23)	46% (N = 26)	56% (N = 32)	65% (N = 35)	48% (N = 25)	56% (N = 27)	61% (N = 25)	55% (N = 18)	65% (N = 11)
	1	36% (N = 26)	30% (N = 19)	27% (N = 17)	36% (N = 22)	33% (N = 20)	38% (N = 23)	37% (N = 21)	33% (N = 19)	30% (N = 16)	37% (N = 19)	33% (N = 16)	29% (N = 12)	33% (N = 11)	18% (N = 3)
	2	7% (N = 5)	11% (N = 7)	13% (N = 8)	10% (N = 6)	8% (N = 5)	7% (N = 4)	18% (N = 10)	11% (N = 6)	4% (N = 2)	15% (N = 8)	6% (N = 3)	10% (N = 4)	12% (N = 4)	18% (N = 3)
	3	0% (N = 0)	2% (N = 1)	3% (N = 2)	2% (N = 1)	2% (N = 1)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	4% (N = 2)	0% (N = 0)	0% (N = 0)	0% (N = 0)
	4	1% (N = 1)	0% (N = 0	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)
	5	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	2% (N = 1)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)
	6	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)
	7	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)
	8	0% (N = 0)	2% (N = 1)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)
Health	0	66% (N = 50)	64% (N = 43)	73% (N = 45)	73% (N = 43)	66% (N = 38)	67% (N = 39)	67% (N = 36)	56% (N = 29)	53% (N = 26)	56% (N = 27)	59% (N = 26)	51% (N = 20)	66% (N = 19)	67% (N = 10)
	1	24% (N = 18)	27% (N = 18)	26% (N = 16)	22% (N = 13)	24% (N = 14)	31% (N = 18)	19% (N = 10)	31% (N = 16)	41% (N = 20)	35% (N = 17)	32% (N = 14)	39% (N = 15)	14% (N = 4)	20% (N = 3)
	2	8% (N = 6)	8% (N = 5)	2% (N = 1)	3% (N = 2)	7% (N = 4)	2% (N = 1)	13% (N = 7)	10% (N = 5)	6% (N = 3)	8% (N = 4)	5% (N = 2)	10% (N = 4)	21% (N = 6)	13% (N = 2)

	3	1% (N = 1)	2% (N = 1)	0% (N = 0)	2% (N = 1)	0% (N = 0)	0% (N = 0)	2% (N = 1)	2% (N = 1)	0% (N = 0)	0% (N = 0)	5% (N = 2)	0% (N = 0)	0% (N = 0)	0% (N = 0)
	4	1% (N = 1)	0% (N = 0)	0% (N = 0)	0% (N = 0)	2% (N = 1)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)
	5	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	2% (N = 1)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)
	6	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	2% (N = 1)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)
Environment	0	59% (N = 48)	51% (N = 38)	53% (N = 37)	60% (N = 41)	56% (N = 38)	68% (N = 44)	69% (N = 45)	71% (N = 46)	63% (N = 39)	65% (N = 39)	66% (N = 38)	60% (N = 32)	56% (N = 28)	61% (N = 20)
	1	35% (N = 28)	35% (N = 26)	33% (N = 23)	35% (N = 24)	32% (N = 22)	26% (N = 17)	22% (N = 14)	23% (N = 15)	29% (N = 18)	30% (N = 18)	29% (N = 17)	32% (N = 17)	28% (N = 14)	27% (N = 9)
	2	4% (N = 3)	12% (N = 9)	10% (N = 7)	2% (N = 1)	10% (N = 7)	3% (N = 2)	6% (N = 4)	6% (N = 4)	5% (N = 3)	5% (N = 2)	3% (N = 2)	8% (N = 4)	14% (N = 7)	9% (N = 3)
	3	1% (N = 1)	0% (N = 0)	3% (N = 2)	2% (N = 1)	2% (N = 1)	0% (N = 0)	2% (N = 1)	0% (N = 0)	3% (N = 2)	0% (N = 0)	2% (N = 1)	0% (N = 0)	2% (N = 1)	3% (N = 1)
	4	1% (N = 1)	1% (N = 1)	1% (N = 1)	2% (N = 1)	0% (N = 0)	2% (N = 1)	2% (N = 1)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)
	5	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	2% (N = 1)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)
Combined	0	57% (N = 47)	42% (N = 31)	55% (N = 41)	51% (N = 35)	55% (N = 38)	63% (N = 43)	63% (N = 42)	60% (N = 40)	54% (N = 34)	59% (N = 37)	62% (N = 37)	53% (N = 28)	53% (N = 25)	69% (N = 20)
	1	34% (N = 28)	49% (N = 36)	31% (N = 23)	44% (N = 30)	32% (N = 22)	29% (N = 20)	28% (N = 19)	33% (N = 22)	38% (N 24)	32% (N = 20)	32% (N = 19)	36% (N = 19)	33% (N = 15)	31% (N = 9)
	2	9% (N = 7)	10% (N = 7)	8% (N = 6)	6% (N = 4)	9% (N = 6)	7% (N = 5)	9% (N = 6)	6% (N = 4)	7% (N = 4)	10% (N = 6)	7% (N = 4)	11% (N = 6)	4% (N = 2)	0% (N = 0)
	3	0% (N = 0)	0% (N = 0)	4% (N = 3)	0% (N = 0)	4% (N = 3)	0% (N = 0)	0% (N = 0)	2% (N = 1)	2% (N = 1)	0% (N = 0)	0% (N = 0)	0% (N = 0)	4% (N = 2)	0% (N = 0)
	4	0% (N = 0)	0% (N = 0)	1% (N = 1)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	2% (N = 1)	0% (N = 0)
	5	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

		(N = 0)	(N = 0)	(N = 0)	(N = 0)	(N = 0)	(N = 0)	(N = 0)	(N = 0)	(N = 0)	(N = 0)	(N = 0)	(N = 0)	(N = 0)	(N = 0)
	6	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	2% (N = 1)	0% (N = 0)
Red Meat															
Control	0	76% (N = 55)	80% (N = 51)	75% (N = 47)	71% (N = 42)	67% (N = 40)	72% (N = 43)	67% (N = 38)	77% (N = 44)	83% (N = 45)	71% (N = 37)	67% (N = 32)	76% (N = 31)	76% (N = 58)	77% (N = 13)
	1	21% (N = 15)	13% (N = 8)	19% (N =12)	21% (N = 13)	30% (N = 18)	28% (N = 17)	28% (N = 16)	21% (N = 12)	15% (N = 8)	25% (N = 13)	25% (N = 12)	22% (N = 9)	24% (N = 8)	12% (N = 2)
	2	3% (N = 2)	8% (N = 5)	5% (N = 3)	8% (N = 5)	3% (N = 2)	0% (N = 0)	5% (N = 3)	2% (N = 1)	2% (N = 1)	4% (N = 2)	8% (N = 4)	2% (N = 1)	0% (N = 0)	12% (N = 2)
	3	0% (N = 0)	0% (N=0)	2% (N = 1)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)
Health	0	83% (N = 63)	80% (N = 53)	82% (N = 51)	83% (N = 49)	81% (N = 47)	88% (N = 51)	82% (N = 44)	67% (N = 35)	67% (N = 33)	67% (N = 32)	73% (N = 32)	74% (N = 29)	76% (N = 22)	80% (N = 12)
	1	12% (N = 9)	16% (N = 11)	18% (N = 11)	17% (N = 10)	17% (N = 10)	12% (N = 7)	15% (N = 8)	30% (N = 15)	31% (N = 15)	33% (N = 16)	23% (N = 10)	21% (N = 8)	17% (N = 5)	13% (N = 2)
	2	4% (N = 3)	5% (N = 3)	0% (N = 0)	0% (N = 0)	2% (N = 1)	0% (N = 0)	4% (N = 2)	2% (N = 1)	2% (N =1)	0% (N = 0)	5% (N = 2)	5% (N = 2)	7% (N = 2)	7% (N = 1)
	3	1% (N = 1)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	2% (N = 1)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)
Environment	0	75% (N =61)	73% (N = 54)	69% (N = 48)	78% (N = 53)	72% (N = 49)	82% (N = 53)	83% (N = 54)	79% (N = 51)	74% (N = 46)	72% (N = 43)	85% (N = 49)	81% (N = 43)	74% (N = 37)	79% (N = 26)
	1	22% (N = 18)	24% (N = 18)	24% (N = 7)	19% (N = 13)	24% (N = 16)	15% (N = 10)	15% (N = 10)	17% (N = 11)	19% (N = 12)	27% (N = 16)	16% (N = 9)	17% (N = 9)	22% (N = 11)	21% (N = 7)
	2	3% (N = 2)	3% (N = 2)	7% (N = 5)	3% (N = 2)	3% (N = 2)	3% (N = 2)	2% (N = 1)	5% (N = 3)	7% (N = 4)	2% (N = 1)	0% (N = 0)	2% (N = 1)	2% (N = 1)	0% (N = 0)
	3	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	2% (N = 1)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	2% (N = 1)	0% (N = 0)
Combined	0	79% (N = 65)	69% (N = 51)	65% (N = 48)	73% (N = 50)	80% (N = 55)	77% (N = 52)	75% (N = 50)	81% (N = 54)	76% (N = 48)	75% (N = 47)	75% (N = 45)	74% (N = 39)	78% (N = 36)	97% (N = 28)

	1	18% (N = 15)	27% (N = 20)	31% (N = 23)	28% (N = 19)	17% (N = 12)	22% (N = 15)	25% (N = 17)	19% (N = 13)	24% (N = 15)	24% (N = 15)	25% (N = 15)	23% (N = 12)	22% (N = 10)	3% (N = 1)
	2	2% (N = 2)	4% (N = 3)	3% (N = 2)	0% (N = 0)	3% (N = 2)	2% (N = 1)	0% (N = 0)	0% (N = 0)	0% (N = 0)	2% (N = 1)	0% (N = 0)	4% (N = 2)	0% (N = 0)	0% (N = 0)
	3	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)
	4	0% (N = 0)	0% (N = 0)	1% (N = 1)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)
Processed Meat															
Control	0	75% (N = 54)	72% (N = 46)	75% (N = 47)	79% (N = 48)	85% (N = 51)	80% (N = 48)	70% (N = 40)	72% (N = 41)	82% (N = 44)	73% (N = 38)	85% (N = 41)	85% (N = 35)	70% (N = 23)	88% (N = 15)
	1	21% (N = 15)	22% (N = 14)	24% (N = 15)	20% (N = 12)	12% (N = 7)	17% (N = 10)	26% (N = 15)	26% (N = 15)	15% (N = 8)	19% (N = 10)	13% (N = 6)	7% (N = 3)	27% (N = 9)	6% (N = 1)
	2	4% (N = 3)	5% (N =3)	0% (N = 0)	2% (N = 1)	3% (N = 2)	3% (N = 2)	4% (N = 2)	2% (N = 1)	2% (N = 1)	8% (N = 4)	2% (N = 1)	7% (N = 3)	3% (N = 1)	6% (N = 1)
	3	0% (N = 0)	0% (N = 0)	2% (N = 1)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)
	4	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)
	5	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	2% (N = 1)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)
	6	0% (N = 0)	2% (N = 1)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)
Health	0	78% (N = 59)	82% (N = 55)	89% (N = 55)	85% (N = 50)	78% (N = 45)	79% (N = 46)	80% (N = 43)	81% (N = 42)	82% (N = 40)	81% (N = 39)	80% (N = 35)	74% (N = 29)	83% (N = 24)	87% (N = 13)
	1	20% (N =15)	15% (N = 10)	11% (N = 7)	14% (N = 8)	16% (N = 9)	19% (N = 11)	15% (N = 8)	12% (N = 6)	18% (N = 9)	19% (N = 9)	18% (N = 8)	23% (N = 9)	10% (N = 3)	7% (N = 1)
	2	3% (N = 2)	3% (N = 2)	0% (N = 0)	2% (N = 1)	3% (N = 2)	2% (N = 1)	4% (N = 2)	8% (N = 4)	0% (N = 0)	0% (N = 0)	2% (N = 1)	3% (N = 1)	7% (N = 2)	7% (N = 1)
	3	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	2% (N = 1)	0% (N = 0)	2% (N = 1)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)

	4	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	2% (N = 1)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)
Environment	0	82% (N = 66)	73% (N = 54)	76% (N = 53)	81% (N = 55)	79% (N = 54)	85% (N = 55)	80% (N = 52)	91% (N = 59)	87% (N = 54)	90% (N = 54)	78% (N = 45)	76% (N = 40)	78% (N = 39)	70% (N = 23)
	1	16% (N = 3)	19% (N = 14)	20% (N = 14)	16% (N = 11)	18% (N = 12)	11% (N = 7)	14% (N = 9)	9% (N = 6)	11% (N = 7)	10% (N = 6)	19% (N = 11)	23% (N = 12)	14% (N = 7)	27% (N = 9)
	2	1% (N = 1)	8% (N = 6)	4% (N = 3)	2% (N = 1)	3% (N =)	3% (N = 2)	6% (N = 4)	0% (N = 0)	0% (N = 0)	0% (N = 0)	3% (N = 2)	2% (N = 1)	8% (N = 4)	3% (N = 1)
	3	0% (N = 0)	0% (N = 0)	0% (N = 0)	2% (N = 1)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	2% (N = 1)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)
	4	1% (N = 1)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)
	5	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	2% (N = 1)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)
Combined	0	76% (N = 62)	69% (N = 51)	82% (N = 61)	77% (N = 53)	70% (N = 48)	81% (N = 55)	81% (N = 54)	76% (N = 51)	73% (N = 46)	79% (N = 50)	82% (N = 49)	73% (N = 39)	72% (N = 33)	72% (N = 21)
	1	21% (N = 17)	30% (N = 22)	14% (N = 10)	19% (N = 13)	25% (N = 17)	19% (N = 13)	18% (N = 12)	19% (N = 13)	24% (N =15)	18% (N = 11)	17% (N = 10)	25% (N = 13)	17% (N = 8)	28% (N = 8)
	2	4% (N = 3)	1% (N = 1)	3% (N = 2)	4% (N = 3)	3% (N = 2)	0% (N = 0)	2% (N = 1)	3% (N = 2)	2% (N = 1)	3% (N = 2)	2% (N = 1)	2% (N = 1)	4% (N = 2)	0% (N = 0)
	3	0% (N = 0)	0% (N = 0)	1% (N = 1)	0% (N = 0)	3% (N = 2)	0% (N = 0)	0% (N = 0)	2% (N = 1)	2% (N = 1)	0% (N = 0)	0% (N = 0)	0% (N = 0)	2% (N = 1)	0% (N = 0)
	4	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	2% (N = 1)	0% (N = 0)
	5	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)
	6	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	2% (N = 1)	0% (N = 0)
Grouped meat alternatives															
Control	0	43% (N = 31)	45% (N = 29)	33% (N = 21)	39% (N = 24)	60% (N = 36)	48% (N = 21)	44% (N = 25)	41% (N = 23)	43% (N = 23)	42% (N = 22)	44% (N = 21)	44% (N = 18)	52% (N = 17)	41% (N = 7)

	1	43% (N = 31)	36% (N = 23)	48% (N = 30)	38% (N = 23)	30% (N = 18)	35% (N = 21)	53% (N = 30)	44% (N = 25)	33% (N = 18)	44% (N = 23)	38% (N = 18)	37% (N = 15)	33% (N = 11)	29% (N = 5)
	2	13% (N =9)	16% (N = 10)	14% (N = 9)	20% (N = 12)	8% (N = 5)	17% (N = 10)	4% (N = 2)	11% (N = 6)	17% (N = 9)	14% (N = 7)	19% (N = 9)	20% (N = 8)	12% (N = 4)	24% (N = 4)
	3	0% (N = 0)	3% (N = 2)	5% (N = 3)	3% (N = 2)	2% (N = 1)	0% (N = 0)	0% (N = 0)	2% (N = 1)	6% (N = 3)	0% (N = 0)	0% (N = 0)	0% (N = 0)	3% (N = 1)	6% (N = 1)
	4	2% (N = 1)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	2% (N = 1)	2% (N = 1)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)
	5	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	2% (N = 1)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)
Health	0	38% (N = 29)	42% (N = 28)	26% (N = 16)	37% (N = 22)	40% (N = 23)	29% (N = 17)	37% (N = 20)	42% (N = 22)	35% (N = 17)	35% (N = 17)	43% (N = 19)	36% (N = 14)	38% (N = 11)	47% (N = 7)
	1	46% (N = 35)	43% (N = 29)	50% (N = 31)	42% (N = 25)	41% (N = 24)	50% (N = 29)	44% (N = 24)	40% (N = 21)	43% (N = 21)	50% (N = 24)	39% (N = 17)	49% (N = 19)	31% (N = 9)	27% (N = 4)
	2	15% (N = 11)	10% (N = 7)	21% (N = 13)	19% (N = 11)	17% (N = 10)	21% (N = 12)	17% (N = 9)	12% (N = 6)	18% (N = 9)	10% (N = 5)	14% (N = 6)	15% (N = 6)	31% (N = 9)	20% (N = 3)
	3	1% (N = 1)	5% (N = 3)	2% (N = 1)	0% (N = 0)	2% (N = 1)	0% (N = 0)	2% (N = 1)	4% (N = 2)	0% (N = 0)	4% (N = 2)	2% (N =1)	0% (N = 0)	0% (N = 0)	7% (N = 1)
	4	0% (N = 0)	0% (N = 0)	2% (N = 1)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	2% (N = 1)	0% (N = 0)	2% (N =1)	0% (N = 0)	0% (N = 0)	0% (N = 0)
	5	0% (N = 0)	0% (N = 0)	0% (N = 0)	2% (N = 1)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	2% (N = 1)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)
	6	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	2% (N = 1)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)
Environment	0	33% (N = 27)	45% (N = 33)	39% (N = 27)	46% (N = 31)	41% (N = 28)	43% (N = 28)	37% (N = 24)	45% (N = 29)	36% (N = 22)	55% (N = 33)	45% (N = 26)	42% (N = 22)	36% (N = 18)	30% (N = 10)
	1	48% (N = 39)	37% (N = 27)	47% (N = 33)	49% (N = 33)	47% (N = 32)	40% (N = 26)	43% (N = 28)	39% (N = 25)	44% (N = 27)	33% (N = 20)	41% (N = 24)	47% (N = 25)	46% (N = 23)	39% (N = 13)
	2	17% (N = 14)	16% (N = 12)	14% (N = 10)	6% (N = 4)	12% (N = 8)	15% (N = 10)	15% (N = 10)	15% (N = 10)	19% (N = 12)	8% (N = 5)	14% (N = 8)	11% (N = 6)	16% (N = 8)	30% (N = 10)
	3	1%	3%	0%	0%	0%	2%	5%	0%	0%	2%	14%	0%	2%	0%

		(N = 1)	(N = 2)	(N = 0)	(N = 0)	(N = 0)	(N = 1)	(N = 3)	(N = 0)	(N = 0)	(N = 1)	(N = 24)	(N = 0)	(N = 1)	(N = 0)
	4	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	2% (N = 1)	2% (N = 1)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)
	5	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)
	6	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)
	7	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)
	8	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	2% (N = 1)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)
Combined	0	42% (N = 34)	39% (N = 29)	47% (N = 35)	35% (N = 24)	36% (N = 25)	40% (N = 27)	45% (N = 30)	40% (N = 27)	49% (N = 31)	46% (N = 29)	30% (N = 18)	40% (N = 21)	48% (N = 22)	28% (N = 8)
	1	43% (N = 35)	42% (N = 34)	39% (N = 29)	54% (N = 37)	44% (N = 30)	47% (N = 32)	42% (N = 28)	40% (N = 27)	41% (N = 26)	44% (N = 28)	47% (N = 28)	43% (N = 23)	44% (N = 20)	48% (N = 14)
	2	15% (N = 12)	15% (N = 11)	11% (N = 8)	12% (N = 8)	20% (N = 14)	12% (N = 8)	13% (N = 9)	16% (N = 11)	10% (N = 6)	10% (N = 6)	23% (N = 14)	17% (N = 9)	9% (N = 4)	17% (N = 5)
	3	1% (N = 1)	0% (N = 0)	3% (N = 2)	0% (N = 0)	0% (N = 0)	2% (N = 1)	0% (N = 0)	2% (N = 1)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	7% (N = 2)
	4	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)
	5	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	2% (N = 1)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)
White meat															
Control	0	56% (N = 40)	61% (N = 39)	44% (N = 28)	44% (N = 27)	62% (N = 37)	62% (N = 37)	56% (N = 32)	53% (N = 30)	52% (N = 28)	58% (N = 30)	60% (N = 29)	56% (N = 23)	64% (N = 21)	59% (N = 10)
	1	35% (N = 25)	25% (N = 16)	43% (N = 27)	42% (N = 26)	33% (N = 20)	32% (N = 19)	42% (N = 24)	40% (N = 23)	35% (N = 19)	37% (N = 19)	33% (N = 29)	37% (N = 15)	24% (N = 8)	18% (N = 3)
	2	8% (N = 6)	11% (N = 7)	11% (N = 7)	12% (N = 7)	5% (N = 3)	7% (N = 4)	2% (N = 24)	5% (N = 3)	11% (N = 6)	6% (N = 19)	6% (N = 3)	7% (N = 3)	12% (N = 4)	24% (N = 4)
	3	0%	3%	2%	2%	0%	0%	0%	0%	2%	0%	0%	0%	0%	0%

		(N = 0)	(N = 2)	(N = 1)	(N = 1)	(N = 0)	(N = 0)	(N = 0)	(N = 0)	(N = 1)	(N = 0)	(N = 0)	(N = 0)	(N = 0)	(N = 0)
	4	1% (N = 1)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	2% (N = 1)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)
Health	0	51% (N = 39)	51% (N = 34)	42% (N = 26)	51% (N = 30)	50% (N = 29)	50% (N = 29)	46% (N = 25)	58% (N = 30)	47% (N = 23)	48% (N = 23)	55% (N = 24)	49% (N = 19)	41% (N = 12)	60% (N = 9)
	1	41% (N = 31)	37% (N = 25)	42% (N = 26)	32% (N = 19)	38% (N = 22)	47% (N = 27)	46% (N = 25)	33% (N = 17)	35% (N = 17)	46% (N = 22)	36% (N = 16)	44% (N = 17)	45% (N = 13)	27% (N = 4)
	2	8% (N = 6)	9% (N = 6)	13% (N = 8)	15% (N = 9)	10% (N = 6)	3% (N = 2)	6% (N = 3)	4% (N = 2)	16% (N = 8)	6% (N = 3)	7% (N = 3)	8% (N = 3)	14% (N = 4)	7% (N = 1)
	3	0% (N = 0)	3% (N = 2)	2% (N = 1)	0% (N = 0)	2% (N = 1)	0% (N = 0)	2% (N =)	4% (N = 2)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	7% (N = 1)
	4	0% (N = 0)	0% (N = 0)	2% (N = 1)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	2% (N = 1)	2% (N = 1)	0% (N = 0)	2% (N = 1)	0% (N = 0)	0% (N = 0)	0% (N = 0)
	5	0% (N = 0)	0% (N = 0)	0% (N = 0)	2% (N = 1)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)
Environment	0	48% (N = 39)	62% (N = 46)	59% (N = 41)	62% (N = 42)	50% (N = 34)	52% (N = 34)	46% (N = 30)	57% (N = 37)	44% (N = 27)	60% (N = 36)	57% (N = 33)	49% (N = 26)	52% (N = 26)	30% (N = 10)
	1	43% (N = 35)	27% (N = 20)	36% (N = 25)	37% (N = 25)	47% (N = 32)	40% (N = 26)	44% (N = 29)	31% (N = 20)	44% (N = 27)	33% (N = 20)	38% (N = 22)	45% (N = 24)	32% (N = 16)	49% (N = 16)
	2	7% (N = 6)	11% (N =8)	6% (N = 4)	2% (N = 1)	3% (N = 2)	6% (N = 4)	6% (N = 4)	11% (N = 7)	11% (N = 7)	5% (N = 3)	5% (N = 3)	6% (N = 3)	16% (N = 8)	21% (N = 7)
	3	1% (N = 1)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	2% (N = 1)	3% (N = 2)	0% (N = 0)	2% (N = 1)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)
	4	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	2% (N = 1)	44% (N = 27)	2% (N = 1)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)
Combined	0	56% (N = 46)	53% (N = 39)	54% (N = 40)	48% (N = 33)	48% (N = 33)	46% (N = 31)	61% (N = 41)	52% (N = 35)	67% (N = 42)	62% (N = 39)	47% (N = 28)	49% (N = 26)	61% (N = 28)	38% (N = 11)
	1	35% (N = 29)	37% (N = 27)	38% (N = 28)	45% (N = 31)	44% (N = 30)	47% (N = 32)	33% (N = 22)	36% (N = 24)	32% (N = 20)	32% (N = 20)	42% (N = 25)	43% (N = 23)	33% (N = 15)	45% (N = 13)
	2	7% (N = 6)	11% (N = 8)	8% (N = 6)	7% (N = 5)	9% (N = 6)	7% (N = 5)	6% (N = 4)	11% (N = 7)	2% (N = 1)	6% (N = 4)	12% (N = 7)	8% (N = 4)	7% (N = 3)	14% (N = 4)

	3	1% (N = 1)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	2% (N = 1)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	3% (N = 1)
Fish															
Control	0	86% (N = 62)	84% (N = 54)	81% (N = 51)	93% (N = 57)	95% (N = 57)	83% (N = 50)	88% (N = 50)	86% (N = 49)	87% (N = 47)	87% (N = 45)	81% (N = 39)	85% (N = 35)	91% (N = 30)	77% (N = 13)
	1	14% (N = 10)	14% (N = 9)	19% (N = 12)	7% (N = 4)	5% (N = 3)	15% (N = 9)	2% (N = 1)	12% (N = 7)	6% (N = 3)	12% (N = 6)	13% (N = 6)	12% (N = 5)	9% (N = 3)	24% (N = 4)
	2	0% (N = 0)	2% (N = 1)	0% (N = 0)	0% (N = 0)	0% (N = 0)	2% (N = 1)	0% (N = 0)	0% (N = 0)	6% (N = 3)	2% (N = 1)	6% (N = 3)	2% (N = 1)	0% (N = 0)	0% (N = 0)
	3	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)
	4	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	2% (N = 1)	2% (N = 1)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)
Health	0	84% (N = 64)	94% (N = 63)	84% (N = 52)	86% (N = 51)	88% (N = 51)	78% (N = 45)	91% (N = 49)	87% (N = 45)	86% (N = 42)	79% (N = 38)	86% (N = 38)	85% (N = 33)	83% (N = 24)	87% (N = 13)
	1	15% (N = 11)	6% (N = 4)	16% (N = 10)	12% (N = 7)	12% (N = 7)	17% (N = 10)	7% (N = 4)	10% (N = 5)	14% (N = 7)	17% (N = 8)	11% (N = 5)	15% (N = 6)	14% (N = 4)	7% (N = 1)
	2	1% (N = 1)	0% (N = 0)	0% (N = 0)	2% (N = 1)	0% (N = 0)	5% (N = 3)	2% (N = 1)	4% (N = 2)	0% (N = 0)	4% (N = 2)	2% (N = 1)	0% (N = 0)	3% (N = 1)	7% (N = 1)
Environment	0	80% (N = 65)	80% (N = 59)	84% (N = 59)	84% (N = 57)	87% (N = 59)	86% (N = 56)	88% (N = 57)	86% (N = 56)	86% (N = 53)	97% (N = 58)	86% (N = 50)	87% (N = 46)	84% (N = 42)	94% (N = 31)
	1	17% (N = 14)	19% (N = 14)	14% (N = 10)	13% (N = 9)	13% (N = 9)	12% (N = 8)	11% (N = 7)	14% (N = 9)	15% (N = 9)	3% (N = 2)	12% (N = 7)	13% (N = 7)	16% (N = 8)	6% (N = 2)
	2	3% (N = 2)	1% (N = 1)	1% (N = 1)	3% (N = 2)	0% (N = 0)	2% (N = 1)	2% (N = 1)	0% (N = 0)	0% (N = 0)	0% (N = 0)	2% (N = 1)	0% (N = 0)	0% (N = 0)	0% (N = 0)
Combined	0	85% (N = 70)	85% (N = 63)	91% (N = 67)	90% (N = 62)	83% (N = 57)	90% (N = 61)	85% (N = 57)	84% (N = 56)	79% (N = 50)	87% (N = 55)	80% (N = 48)	85% (N = 45)	89% (N = 41)	97% (N = 28)
	1	15% (N = 12)	14% (N = 10)	10% (N = 7)	9% (N = 6)	17% (N = 12)	10% (N = 7)	13% (N = 9)	16% (N = 11)	18% (N = 11)	13% (N = 8)	18% (N = 11)	11% (N = 6)	9% (N = 4)	3% (N = 1)
	2	0% (N = 0)	1% (N = 1)	0% (N = 0)	1% (N = 1)	0% (N = 0)	0% (N = 0)	2% (N = 1)	0% (N = 0)	3% (N = 2)	0% (N = 0)	2% (N = 1)	4% (N = 2)	2% (N = 1)	0% (N = 0)

Plant-based meat alternatives															
Control	0	97% (N = 70)	97% (N = 62)	98% (N = 62)	92% (N = 56)	98% (N = 59)	95% (N = 57)	100% (N = 57)	93% (N = 53)	96% (N = 52)	96% (N = 50)	96% (N = 46)	93% (N = 38)	94% (N = 31)	94% (N = 16)
	1	3% (N = 2)	3% (N = 2)	2% (N = 1)	7% (N = 4)	0% (N = 0)	5% (N = 3)	0% (N = 0)	5% (N = 3)	4% (N = 2)	0% (N = 0)	4% (N = 2)	7% (N = 3)	3% (N = 1)	6% (N = 1)
	2	0% (N = 0)	0% (N = 0)	0% (N = 0)	2% (N = 1)	2% (N = 1)	0% (N = 0)	0% (N = 0)	2% (N = 1)	0% (N = 0)	4% (N = 2)	0% (N = 0)	0% (N = 0)	3% (N = 1)	0% (N = 0)
Health	0	96% (N = 73)	94% (N = 63)	94% (N = 58)	98% N = 58)	95% (N = 55)	91% (N = 53)	93% (N = 50)	92% (N = 48)	94% (N = 46)	100% (N = 48)	98% (N = 43)	97% (N = 38)	100% (N = 29)	93% (N = 14)
	1	3% (N = 2)	5% (N = 3)	5% (N = 3)	2% (N = 1)	5% (N = 2)	7% (N = 4)	6% (N = 3)	6% (N = 3)	4% (N = 2)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	7% (N = 1)
	2	2% (N = 1)	2% (N = 1)	2% (N = 1)	0% (N = 0)	0% (N = 0)	2% (N = 1)	2% (N = 1)	2% (N = 1)	2% (N = 1)	0% (N = 0)	0% (N = 0)	3% (N = 1)	0% (N = 0)	0% (N = 0)
	3	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	2% (N = 1)	0% (N = 0)	0% (N = 0)	0% (N = 0)
Environment	0	98% (N = 79)	96% (N = 71)	93% (N = 65)	99% (N = 67)	97% (N = 66)	99% (N = 64)	92% (N = 60)	97% (N = 63)	97% (N = 60)	92% (N = 55)	95% (N = 55)	100% (N = 53)	96% (N = 48)	97% (N = 32)
	1	3% (N = 2)	3% (N = 2)	3% (N = 2)	2% (N = 1)	2% (N = 1)	0% (N = 0)	8% (N = 5)	3% (N = 2)	3% (N = 2)	5% (N = 3)	5% (N = 3)	0% (N = 0)	0% (N = 0)	3% (N = 1)
	2	0% (N = 0)	0% (N = 0)	4% (N = 3)	0% (N = 0)	2% (N = 1)	2% (N = 1)	0% (N = 0)	0% (N = 0)	0% (N = 0)	2% (N = 1)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)
	3	0% (N = 0)	1% (N = 1)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)
	4	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)	2% (N = 1)	0% (N = 0)	0% (N = 0)	0% (N = 0)	0% (N = 0)
Combined	0	93% (N = 76)	99% (N = 73)	95% (N = 70)	96% (N = 66)	94% (N = 65)	97% (N = 66)	93% (N = 62)	94% (N = 63)	98% (N = 62)	94% (N = 59)	95% (N = 57)	100% (N = 53)	98% (N = 45)	83% (N = 24)
	1	7% (N = 6)	1% (N = 1)	5% (N = 4)	3% (N = 2)	6% (N = 4)	3% (N = 2)	8% (N = 5)	5% (N = 3)	2% (N = 1)	6% (N = 4)	3% (N = 2)	0% (N = 0)	2% (N = 1)	17% (N = 5)
	2	0% (N = 0)	0% (N = 0)	0% (N = 0)	1% (N = 1)	0% (N = 0)	0% (N = 0)	0% (N = 0)	2% (N = 1)	0% (N = 0)	0% (N = 0)	2% (N = 1)	0% (N = 0)	0% (N = 0)	0% (N = 0)

Note. This table shows the continuous data, relating to the number of portions consumed by participants during each day of the two-week intervention, as recorded in the food diaries. Dichotomous outcome variables were used for the analysis reported in chapter 6.

Percentage totals do not always exact 100% due to rounding.